

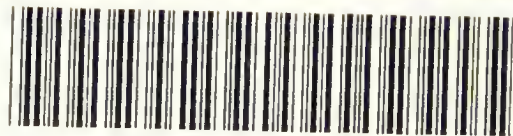
# HEROES & MARTYRS OF SCIENCE



HENRY C. EWART

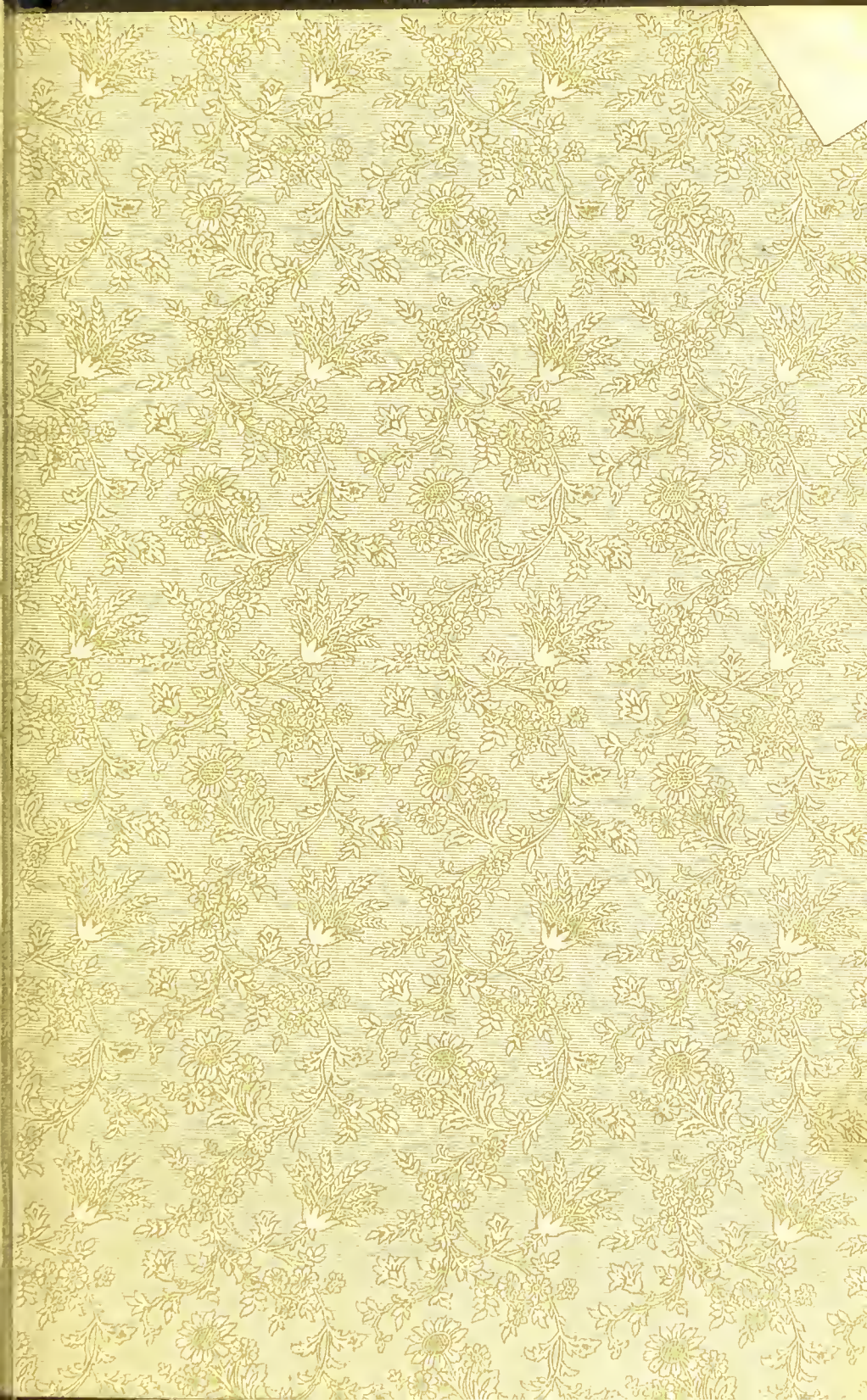


RE 11(1)



22101519219



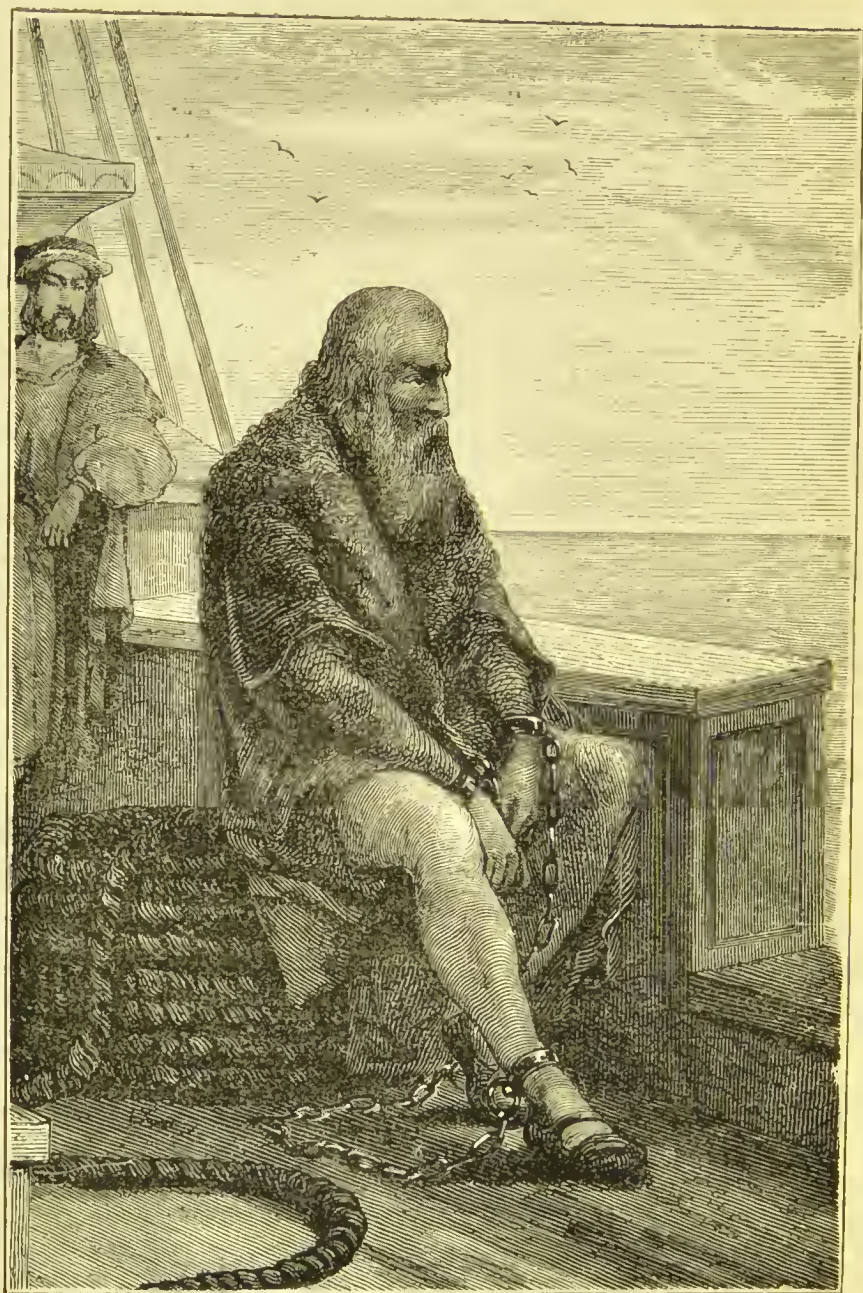


N. II b  
19



14853





*Frontispiece.*

COLUMBUS IN FETTERS.



# HEROES AND MARTYRS OF SCIENCE

BY HENRY C. EWART

*WITH THIRTY ILLUSTRATIONS*



LONDON  
WM. ISBISTER LIMITED  
56 LUDGATE HILL  
1886



SCIENCE, 1892 (2)

AB, D(2)

LONDON :

PRINTED BY J. S. VIRTUE AND CO., LIMITED,  
CITY ROAD.

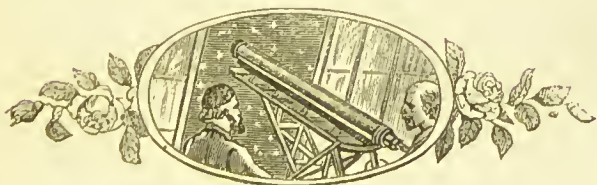




# CONTENTS.

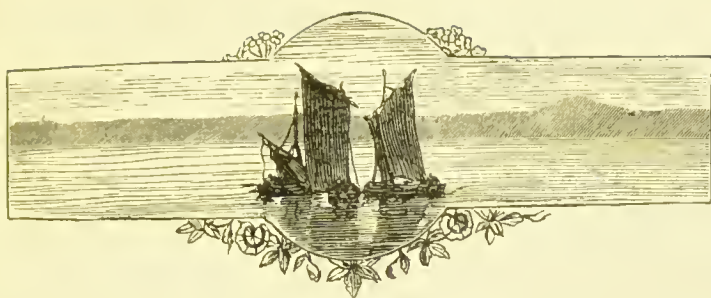
---

	PAGE
I. THE DISCOVERER OF AMERICA . . . . .	7
II. FRIAR BACON . . . . .	67
III. GALILEO . . . . .	89
IV. JOHN KEPLER . . . . .	126
V. SIR ISAAC NEWTON . . . . .	146
VI. DENIS PAPIN . . . . .	191
VII. THOMAS CAMPANELLA . . . . .	207









# THE DISCOVERER OF AMERICA.

---

## CHAPTER I.

### A GREAT GIFT.



WHAT is the greatest gift that any one man ever gave to his fellow-men? It would not be easy to answer that question. But this we may safely say, that among all the greatest gifts conferred upon mankind by inventors and discoverers there can hardly have been any greater than the one received from Christopher Columbus. For he gave to us just about half of the world we live in. If you open your atlas you find that a map of the world stands at the beginning. This map of the world is divided into two parts, the



eastern hemisphere or the "old world," and the western hemisphere or the "new world." Why is the western hemisphere called the "new world?" Because down to the year 1492 no one in Europe, Asia, or Africa, knew anything about it.

We do not say that no one from the old world had ever seen it before that time, because this would scarcely be true. It is tolerably certain that Norsemen from Iceland had landed many centuries earlier in North America, which they called Vinland. They also had settlements in Greenland. But the voyage across the icy northern seas was so difficult and dangerous that communication was not kept up. The discovery of Vinland came to be treated as an old legend, and the settlers in Greenland died out.

Besides, America was not uninhabited when Columbus discovered it. And as the inhabitants did not spring out of the soil, they must have come from the old world. It is believed they came originally from Asia. But that was so very long ago that they had forgotten all about it, and their Asiatic relations had also forgotten them. It is therefore substantially true that down to the year 1492 America was no more known to the rest of the world, and was of no more use to it, than if it had been a land in the moon.

How was it possible that one half of the earth should have remained so long unknown to the other half? Well, for one thing, the ancients had very wrong notions about the shape of the earth. Most of them believed that it was a flat expanse of land surrounded on all sides by the great "ocean stream." There was no use therefore in attempting to cross the great ocean. It could lead to nothing. They did not try to picture what was at the other side. So far as they could understand, it had no other side at all. Now and then wise men arose who said that the earth was not flat, but round. However, there were very few who believed them; and most thought they were mad. For, said the million, seeing is believing; and wherever there is room enough to see a long way, as, for instance, on a wide plain, we can *see* that the earth is as flat as a pancake. Now a man who does not believe the evidence of his own eyes must certainly be mad. It did not occur to them to remark that they also saw the sky coming down to the ground all round the edges of the plain. And on the same showing—if seeing was believing—they ought to have believed the evidence of their own eyes that if they walked to the end of the plain they could touch the clouds. But this they knew very well



they could not do, whatever their eyes said on the subject. And had they reflected on this puzzle they might have learned that those who said the world was round were not so very mad after all.

At last arose the astronomer Copernicus, who, about 1450, declared he could prove not only that the earth was a globe, but that it spun round on its own axis, and also rolled round the sun once every year. There was no gainsaying his arguments; but people who could not understand them still said that this was very wicked doctrine, because all the fathers had taught that the sun moved round the earth, as in fact could be seen every day of the week. Yet little by little practical men began to make their calculations according to the new teaching. For instance, they said, if the earth really is round, the Atlantic Ocean must stretch away to the eastern coast of Asia. They never supposed that there was a vast continent in their way before they could reach Asia.

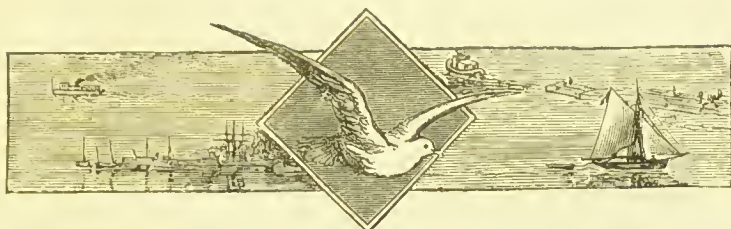
Now there was even at that time a considerable trade with India, and many fables were told of the enormous wealth of that country. The trade was carried on with great difficulty, because most of it was conducted overland. Besides, the Turks had conquered the parts of Asia through which this trade mainly passed, and as they were

nearly always at war with European states the merchants suffered great losses. A passage had indeed been discovered round the Cape of Good Hope, but it appeared a very round-about voyage ; and some began to say that if the earth really was round the straightest way and the most direct would be to sail due west from the coast of Spain until land was reached on the other side of the great ocean. A map drawn about that time will show better than any words what were the notions that began to prevail as to the geography of the world. It will be seen that the shores of India were supposed to be directly opposite to Spain. There is no sign of any continent between. There is indeed a great island marked near the north-eastern coast of Asia ; and some have thought that this shows some dim idea of America. It is more probable, however, that it represents Japan. Be that as it may, it is likely enough that Christopher Columbus often pondered over some map like this when he was yet a young man. And this amongst other things fired his mind with an ardent desire to be the first to open up this new and direct passage to India. He little thought how much greater a discovery he was to make.

It is true that to us it appears a very simple thing to embark on the coast of Europe and to



keep on sailing westward till the shore of America is touched. So the idle courtiers of Spain thought after the thing had been done. In reply to which, it is said that Columbus challenged them to make an egg stand on end. And when none of them could manage it, he tapped one end gently on the table, thus flattening the shell and leaving the egg erect. "Pooh! any one can do that!" they cried. "Just so," he answered; "after you have seen it done." But until the little vessels of Columbus had actually crossed the mysterious, shoreless ocean and returned, those very courtiers had sneered at him as a madman or a fraudulent adventurer; and the gods of their idolatry had denounced the very suggestion of his enterprise as flat blasphemy. In fact, Jules Verne's story of a flight to the moon inside a hollow projectile fired from an artificial volcano, can hardly seem wilder to us in these times than the proposal of Columbus to overpass the bounds of the habitable world appeared in the middle of the fifteenth century. The man who by sheer persistency of unconquerable conviction bored his way through such obstacles of inert stupidity and explosive bigotry, must surely have had something in his character worth studying.



## CHAPTER II.

### EARLY ADVENTURES.



ABOUT the beginning of the great discoverer's life we are left in much doubt, owing to the carelessness of his first biographer, Fernando Columbus, his son by a second wife. But it is generally believed that he was born in 1435 or 1436 at Cogoletto, a suburb of Genoa. The boy was sent, it is said, to the University of Pavia. But on the conjectures that have been made about his childhood and earliest youth it would be unprofitable to dwell. It is out of a sea-fight, in which he nearly lost his life, that Columbus first emerges into the clear light of history. The adventure was so sensational, and its results so romantic, that belief is somewhat difficult. But allowing for some little exaggeration, we may accept the narrative of Fernando.



There were several relatives of Columbus who followed a seafaring life, some of them not in the most honest fashion. One was a Genoese admiral; another was a nephew of the latter, and made himself the terror of the seas by enterprises difficult to distinguish from piracy. Venice and Genoa could always find excuses for capturing each other's shipping. When, therefore, the two Columbuses, cruising off the north-west coast of Spain, heard of four Venetian galleys on their return from Flanders, they had no scruple about undertaking their capture. They succeeded in falling in with them between Lisbon and Cape St. Vincent, hugging the land much closer than is customary in a similar voyage now. A desperate fight ensued, which is said to have lasted all day, without decisive advantage on either side. Toward sunset Christopher Columbus grappled one of the galleys to his own vessel. But in the struggle the galley caught fire. As the sun went down the red light of the flames showed haggard, blood-stained men forgetting their mutual hate in dread of a more pitiless foe, and rushing hither and thither on the slippery decks in the attempt to extinguish the flames, or at least to separate the ships. In vain! The fire enwrapped them both. The glare that lighted up the nearer

waves showed no help at hand ; and round that glare was a wall of darkness made visible. The only choice now lay between the raging furnace and the outer darkness. With characteristic decision Columbus dropped into the sea, having only an oar in his hand, and supporting himself by this swam for six miles, and at last reached the shore.

We are not informed of the date of this adventure ; but Columbus must have been more than thirty years old when it occurred. At this age he found himself cast ashore in a foreign land, shipwrecked and destitute. At Lisbon he was sure of meeting with some of his Genoese fellow-countrymen, and he accordingly made his way thither. He was not disappointed, and the friends he found there helped him to employment. He turned his attention to map drawing, and earned sufficient, at any rate, to place him above the reach of want. But such employment was not the best thing that he found in Lisbon. With him, as with many others, marriage was the turning-point of his career, and he would seem to have amply proved the truth of the Scripture—"Whoso findeth a wife findeth a good thing, and shall obtain favour of the Lord."

According to the ideas of his time Columbus was a religious man. He diligently frequented a

conventual church of the city ; but though his first attendances there may have been prompted by disinterested devotion, there were other reasons for the increased assiduity with which he continued them. There was, connected with the convent, a girls' school for the daughters of well-to-do citizens, and the pupils were in the habit of regularly hearing mass in the church. One of them—would that we could recall her features, long mouldered into dust—attracted the admiration and the love of the weary mariner. There must have been a considerable disproportion in their ages, for he was no longer young ; but he was convinced he had met his fate, and the inquiries he made confirmed his ardour. She was the daughter of a distinguished sailor, Bartolomeo Palestrello, who had been Governor of Porto Santo, an island near Madeira. Her father had died without leaving behind him any fortune ; but her mother still survived, and must have possessed means of her own. Columbus was accepted as a suitor, and, what to young men in these times must seem a very extraordinary course of procedure, after his marriage he and his wife took up their abode with his mother-in-law.

We would give a good deal to know more of that love-story ; how it was, for instance, that the



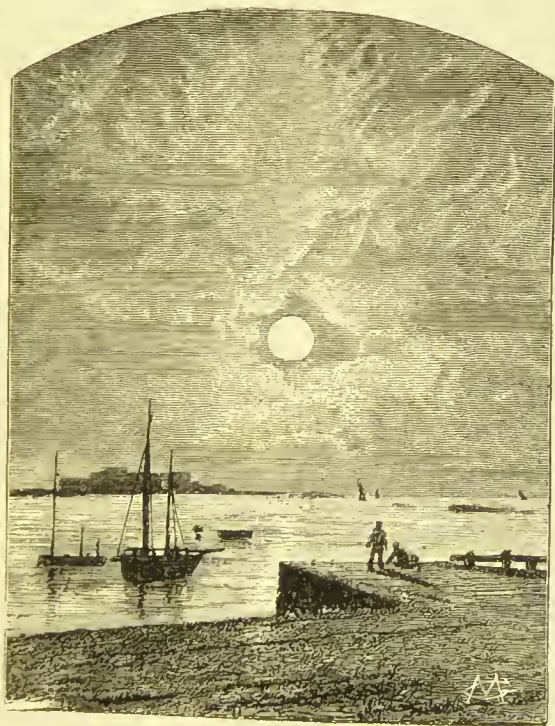
east-away adventurer, reduced to earn his living by drawing charts, managed so to ingratiate himself with the mother, whose husband's position might have enabled her to look higher for her daughter. He must surely have been not only a devoted lover but a man of a good deal of tact, with great power of adapting himself to circumstances. At any rate, the union proved a happy one. We fancy that the suitor must have won the mother's heart by the interest he showed in her deceased husband's achievements ; for after the marriage much of the household conversation turned on this subject, and Columbus heard what fired his soul with emulation. Palestrello had been a man of much enterprise, and he had left behind him papers and maps, which proved to be of more service to his son-in-law than any wealthy inheritance.

It was perhaps the inspiration of these documents that prompted him to avail himself of opportunities afforded by his new position to make voyages down the coast of Guinea. But his heart yearned more and more to the tantalizing horizon of the west, and he began to extend his studies from the manuscripts of his father-in-law to old books and records that promised any light on the one fascinating problem.

About 1475, when the future discoverer was forty years old, he had a correspondence with the Italian astronomer Toscanelli, who entertained very decided views as to the possibility of a western voyage. It seems probable, from the evidence of the log kept by Columbus in his first trans-Atlantic voyage, that this correspondence cleared up his ideas and finally settled his convictions. Another experience that helped to ripen his determination was a long visit to Porto Santo. His father-in-law had been governor of this island, and his wife inherited an estate there. The income was a great addition to his scanty means; but that was the least part of the benefit he received; for as is always the case when a man's mind is fixed on one subject, all that he learned of the Atlantic islands pointed in one direction.

The inhabitants told him of sights they had had when far out at sea, of unnamed islands toward the setting sun. It was all imagination, but it stimulated Columbus as much as if it had been fact. A Portuguese pilot told him of a piece of wood, quaintly carved, picked up in the ocean after drifting before the west wind from unknown regions. And more startling than all else, he heard that on the strand of the Azores corpses

were sometimes east up by the tide, whose strange physiognomy was unlike that of any known race of men. Profoundly as such stories interested him, Columbus was not the man to base an unprecedented undertaking on mere surmise or gossip. Such information sent him afresh to his books and charts, until his ripened conception became an intolerable burden from which he must find relief by decisive action.







### CHAPTER III.

#### A CHAPTER OF DISAPPOINTMENTS.

**H**IS first application was to John II., King of Portugal. It was not merely money that he wanted, though no doubt it would have been far beyond his private means to get up the proposed expedition at his own expense; but Columbus, though determined to succeed, was also determined to succeed only on certain conditions, and these involved an assurance of wealth, power, and dignity for himself. We are not blaming him; such are the common ends of life. We only note it as an indication that heroic as that man undoubtedly was in his marvellous patience, in his power of self-compression and in his unconquerable will, he yet did not belong to that highest type of heroism in which self is effaced by a mission or an idea. Columbus had a notion to sell to the king, and he

was, as inexorable about its price as the Sibyl with her books.

He obtained an audience, he stated his project, to which his Majesty replied only by an incredulous stare. He unfolded his charts. The king looked weary, possibly yawned; but Columbus was a good talker; and when a good talker is thoroughly master of a great subject, even unwilling listeners are aroused to interest. The king began to think there might be something in it, and made objections. Columbus had anticipated them all. The king, almost convinced, urged fanciful difficulties as conclusive; Columbus, perhaps complimenting his august opponent on his wonderful understanding, met royal pedantry with dexterous tact. The cause was won. The monarch owned himself satisfied.

But then came the question of the price at which the adventurous sailor was willing to do this job of discovery and possible conquest. Now doubtless some of us would like Columbus to have replied that with so gracious a master he would make no bargain; that it would be sufficient reward for him if he opened a new gate to the commerce of the world; and that he would leave anything else to the king's sense of the value of his services. But this was what the real

Columbus would not have understood ; he took in a very literal and even mercenary sense the scriptural saying that “the labourer is worthy of his hire.”

It does not appear what were the terms demanded on this occasion ; but they were probably similar to those afterwards asked from the King of Spain—the rank of Admiral, the title of Viceroy over all new lands discovered, and a tenth of any revenues accruing. In a nameless adventurer any such demands appeared exorbitant ; and the king, in the hope of beating them down, ended the audience with a promise of consideration. In the meantime the royal huckster called to his aid a wily doctor, who suggested that the sea was open and that it was very easy to test the value of such speculations. Let a competent sailor be sent out with secret orders, under pretext of an errand to the Cape Verde Islands. He might be sent professedly to carry provisions thither, and would thus be prepared for a longer voyage without exciting curiosity. If all that was needed was to follow the setting sun, any one could do that ; it would soon be seen whether the Genoese was anything more than a visionary, and if success followed the king would be bound by no promises.

Royal birth is no guarantee for magnanimity ;



and this mean proposal was regarded as a piece of clever statecraft. Long afterwards, when the fame of Columbus and his discovery filled the world, Portuguese writers tried to put a different face on this transaction. But though it may be true, as they urge, that a council of the most learned men in the realm was called and that the proposal was honestly rejected by them, it still seems to be indisputable that the disreputable trick we have described was attempted, and that a vessel was actually sent out for the purpose. The state of navigation at this time will account for the failure that followed. The captain could not steadfastly keep his course for many days out of sight of land, and becoming frightened at the unexpected magnitude and perplexity of his task he returned home, declaring that the Genoese was a dreaming fool. There was no longer any room for theorizing. He as a practical sailor had tried the experiment and could testify that in the interminable waste of waters there was no speck of land to be seen.

The pride of Columbus revolted against the paltry trick that had been played on him. Any further arguments or entreaties addressed to such a patron would be an unendurable torment to his self-respect. And therefore, without the least misgiving as to his project, he determined to carry

it elsewhere. Nine years had passed away in fruitless schemes and negotiations since the correspondence with Toscanelli had changed his dreams into firm resolve. He had neglected his ordinary business as a chart drawer, in the hope of more brilliant fortune. Whatever property his wife possessed was wasted by the expenses to which he had been put. There is reason to suspect that he was considerably in debt. To add to his troubles his wife died about the time when his hopes of the Portuguese king were contemptuously blighted. And so he was left, at nearly fifty years of age, to mourn over a desolate hearth and a wasted life. But Columbus was not the man to consume his soul with vain regrets. Nothing is more remarkable in his career than the imperturbable constancy with which he looked on every reverse as merely a momentary delay in the accomplishment of an inevitable success.

About the end of 1484 Columbus left Lisbon, taking with him his only son, and, like the patriarch of old, "went forth, not knowing whither he went." He may have already proposed to try his fortune at the Spanish court. But during the year that followed little or nothing is known of his movements. It is said that he visited Venice and Genoa with the hope of inducing the senators of

these commercial republics to aid him. But however that may be, we find him in 1485 at Palos, in Andalusia. There was a Franciscan monastery outside the town, where poor travellers used to apply for aid. One day Columbus, leading his boy by the hand, knocked at the door of this refuge, and begged, for the love of Heaven, that a little bread and a draught of water might be given to the child. He was desired to enter, and as he sat within waiting for the promised alms, the prior, Juan Perez de Marchena, passed by. Something in the appearance of Columbus arrested his attention, and he stopped to speak with him. No man could live the life of aspiration, study, and adventure this poor wanderer had lived without acquiring a stamp of character such as no shabbiness of vesture could hide. "He was," says his son, "well shaped and of more than middle stature, long-visaged, his cheeks somewhat full, neither fat nor meagre; he had an aquiline nose, his eyes clear, his complexion white, with a lovely red. In his youth his hair was fair, but when he came to thirty years of age it all turned grey."

As soon as the prior had engaged him in conversation it was quite apparent that there was here some personal mystery of absorbing interest. Seeing the mingled curiosity and compassion of the

prior, Columbus unfolded something of his story, and the result was an invitation to repose himself for some days at the monastery. The acquaintanee rapidly ripened, and the prior was soon put in possession of the quenehless ambition of his strange guest, and of all the grounds on which he rested his uneonquerable faith. Perez de Marchena was no ignorant monk who sought the eloister through dislike of work. If not a great seholar himself, at least he felt the stirring of the world's awakening intelleet around him, and the ideas of Columbus quite enthralled his imagination. The brethren of the convent were perhaps slow in sympathy ; but in the town of Palos was a lively physieian, whose eompany the prior speedily requested, that he might hear these visions of a world beyond ehaos.

The physieian had intelligenee enough to understand the reasoning of Columbus, and eonfirmed the faith of the prior. The latter now cast about to find some means of aiding the enterprize, and bethought him of a former aequaintaneeship with Fernando de Talavera, the eonfessor of the Queen. To this ecelesiastic he wrote a letter of introduction for Columbus, highly eommending his genius, and beseeching Fernando to procure for him an audienee at court. With a generosity that deserves



immortal remembrance, the good monk provided the poor adventurer with an outfit suitable for his appearance before the grandees of Spain, and also with a purse of money to sustain him. He offered also to take charge of the boy during his father's absence; and so with a grateful heart and suddenly brightened prospects, Columbus set out afresh.





## CHAPTER IV.

### THE DAWN OF SUCCESS.



HE court was then at Cordova. The kingdoms of Aragon and Castile had been united by the marriage of Ferdinand and Isabella. Unfortunately for Columbus the forces of both realms were then strained to the utmost in the conquest of Granada, the last remnant of the Moorish dominion. Ferdinand was an ambitious, clear-headed monarch, who knew the advantage of a character for wisdom and piety. He was keenly alive to any prospect of substantial advantage, but little likely to be moved to enthusiasm by the grandeur of any design which, in a pecuniary sense, might appear a doubtful speculation. Isabella, on the other hand, was a woman of generous sentiment, as readily fired by the idea of propagating religion as by any promise of enlarged dominion.

But she was no dreamer or weakling. She was quite capable of maintaining her position as an independent sovereign even against her husband.

In 1486 Ferdinand was at the war, and Isabella fully occupied with anxious affairs of state. The time, therefore, was not propitious. And even if it had been, the letter of introduction with which Columbus was provided proved to be of no use. The Queen's confessor regarded his project as an impracticable dream, and delayed indefinitely the interview for which he asked. Months of tantalising suspense once more exhausted his means, but his inward resources were inexhaustible. He reverted to his former business of map drawing; but at Cordova it would scarcely have kept him from starvation, had not the faithful Perez, the monk of Palos, sent more than once to his assistance. But though Talavera failed him, and to frivolous courtiers he seemed a babbler of absurdities, he nevertheless made friends. Neither neglect, nor contempt, nor weary delay could quench or slacken the inward flame of clear and luminous purpose. His resistless earnestness, his mastery of his subject, his facility of expression, gained him a few adherents, who became passionately attached to his views. Amongst these the most important were the papal nuncio, Antonio

Geraldini, and his brother Alexander, tutor to the children of the royal family. These two friends obtained for him an audience of a much greater personage, the Cardinal Archbishop of Toledo.

This ecclesiastie was as powerful in Spain as Wolsey afterwards became in England; and in capacity he was perhaps little, if at all, inferior. He knew little indeed of the widening problems of geography; but a master-mind can generally appreciate a truly great idea, even if it belong to an unfamiliar range of thought. At first the cardinal was startled by propositions that seemed at variance with the letter of Scripture. But Columbus succeeded in convincing him that the opposition was only apparent, and then the way was open for the whole phalanx of arguments now marshalled in perfect form by frequent use. The cardinal was captivated by the profound conviction and clear statement of his suitor. He recognised the possibility of enormous results from the enterprise, and finally promised to use his influence in obtaining an audience from the King and Queen. And now at last success appeared to be within the grasp of the patient toiler. It was known that the maritime achievements of Portugal had excited the envy of Ferdinand. The Archbishop of Toledo was himself convinced, and had unrivalled weight



in the royal councils. The Queen would be predisposed in favour of any enterprise that promised at once the propagation of the faith over unknown regions and an extension of the glory of Spain. It was, therefore, with high and confident hope that Columbus entered the royal presence.

But the King was cautious and diffident of his own judgment in a matter so entirely beyond his knowledge. He therefore delayed his decision until an assembly of the most notable mathematicians, astronomers, and geographers in his realm should have sat upon the subject and given their judgment. It was a bad omen that Talavera, who had treated the letter of the faithful Perez so contemptuously, was appointed to convene this conference. It assembled at Salamanca, and, as the manner of such conferences is, it wasted a great deal of time in irrelevant talk, and finally broke up without coming to any decision at all.

The truth is that the lingering war against the Moors, of which every campaign was now expected to be the last, occupied the whole attention of the King and Queen, and consequently of their Ministers. No pressure was therefore put upon the Commission of Inquiry. On the contrary, Talavera, and probably other members of it, had duties

which required them to follow the court in all its movements.

So matters went on till 1491, when the Commission of Inquiry made its report. It sagely decided that the ideas of Columbus had no rational foundation, and that the proposed adventure was a harebrained scheme totally unworthy of great sovereigns like Ferdinand and Isabella. The latter did not altogether agree with the decision, and sent Columbus a consolatory but dilatory message. He was now, however, about fifty-six years old, and felt that his shortening days would not allow of this sort of trifling any longer. But before finally quitting Spain he made application successively to two great dukes, Medina-Sidonia and Medina-Cœli, whose revenues would easily have borne the expenses of his expedition. The proposal having been declined, the disappointed but still resolute man took his way to his old friend, the prior at Palos, to pay him a farewell visit before going to France, and, if necessary to England.

The warm-hearted Perez now showed the steadfast loyalty of his nature. History, alas! records few such instances of generous and disinterested devotion. If he had been animated merely by ambition to play the patron of an achievement

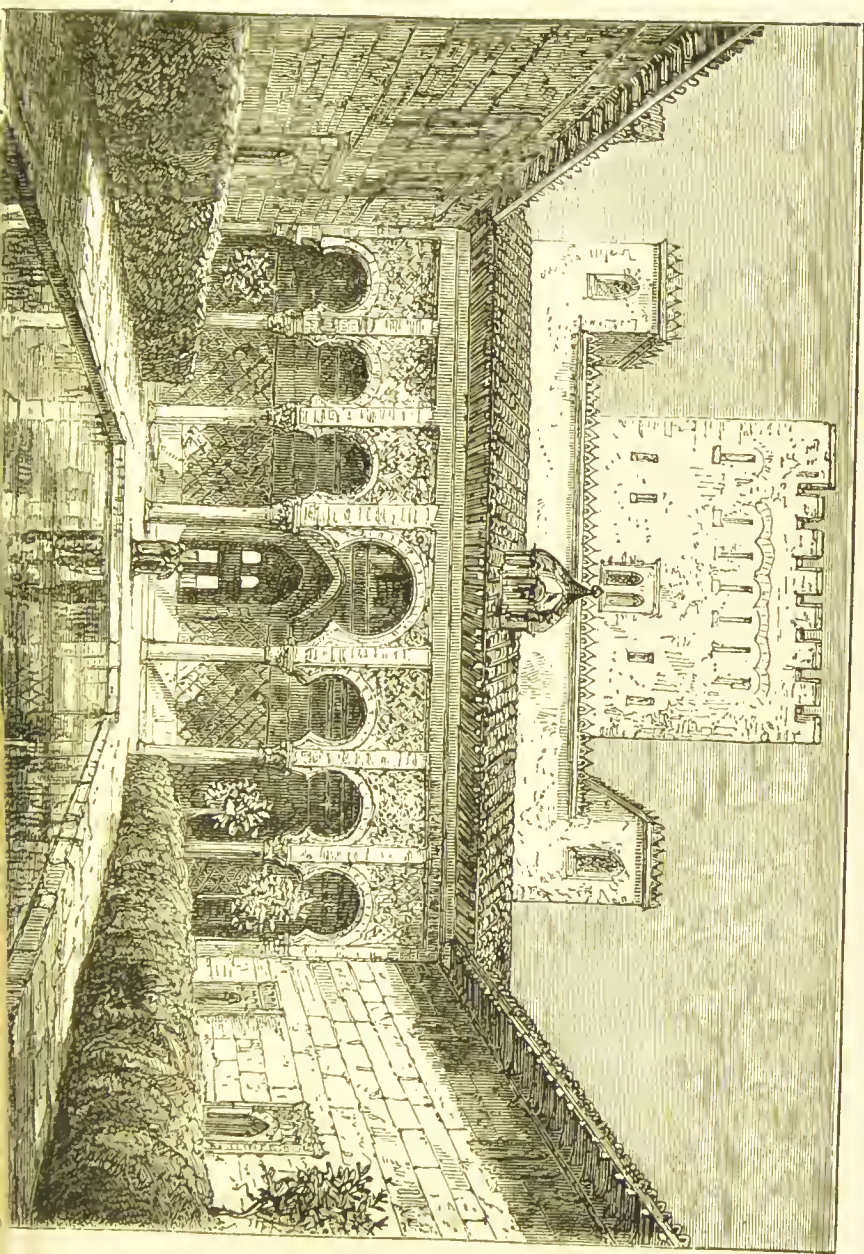
likely to be famous, he would have been easily dismayed by the incredulous contempt of the world, and would have felt relief in getting rid of a hopeless adventurer. Not so Juan Perez. He wanted nothing for himself ; he only wanted the work done. He listened to his friend's story ; he was convinced that all hope was not yet gone, and conjured Columbus to delay his departure until another effort had been made on his behalf. He had himself been formerly confessor to Isabella, and he presumed upon this old connection to write her an earnest letter, beseeching her not to allow so honourable a project to be handed over to a foreign power. This letter was dispatched by a special messenger, who returned with a summons from the Queen to Perez to wait upon her. The old man saddled his mule at once, and travelled with haste, alone and unguarded, through a mountainous country disturbed by soldiers and marauders, till he arrived at the seat of war, where he was admitted without delay to an audience. He was by this time well acquainted with the subject in hand, and he drew such a picture of the loss Spain might suffer if forestalled in so grand a discovery, that the Queen became alarmed, and asked to see Columbus once more. Still further as an earnest of her sincerity, she intrusted Perez

with a sufficient sum of money for the expenses of his friend.

Overjoyed at his success, the monk hastened back with his tidings, and the beginning of 1492 found Columbus again at the court. He arrived at a fortunate moment. The conquest of Grenada was completed. Columbus saw the keys of the Alhambra surrendered to their Catholic Majesties by the last Moorish king, Boabdil, and in the joy of victory orders were given to a new commission to arrange terms with Columbus. The commissioners felt in fact that this was all they had to do. There was now no mistake as to the royal intention that the enterprise should go forward. But the grandees naturally expected that a nameless man, without ancestors, rank, or office, would be exceedingly modest as to the conditions he demanded. They little understood the indomitable pride of that unblenching soul. Nothing would satisfy him but the rank of admiral, the title of viceroy, and a tenth of all revenues forthcoming from the lands he might discover. Little did Columbus imagine that he was asking for his descendants the tithes of nearly half the world.

The objections of the commission, however, were founded on very different reasons. Such honours conferred on a foreigner of low extraction

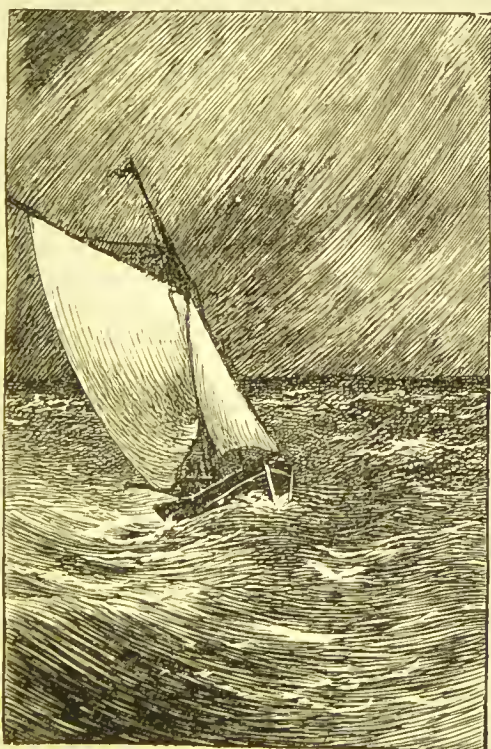




would be a stain on the Crown itself. There was more force in the argument that a great part of the reward was to be given before the work was done, although the general opinion refused to credit the possibility of its accomplishment at all. Columbus, however, had no doubts whatever. Let him have the ships, and the thing was done ; but he would have them on his own terms, or he would go elsewhere. The commission reported to the Queen the unreasonable demands made, and did not fail to set them in the most odious light. The Queen herself thought her *protégé* was overstepping the mark, and supported the commission. They offered Columbus what they considered more reasonable terms, intimating that if these were refused the negotiation was at an end. To the amazement and grief of all his friends, the imperturbable man calmly took the commissioners at their words, and quitted the place.

He departed to his lodgings, paid his bills, packed up his baggage, and set out once more upon his travels. He had reached a bridge six miles from Granada, when he heard the clatter of hoofs behind him. Turning round, he saw a Queen's messenger approach with speed and signal him to stop. He was informed that her Majesty, at the instance of some powerful friends, had decided to

reconsider the subject, and that in effect all his conditions would be granted. Even then he was in no hurry to return. He was sick of courtly indecision, and half disposed to persist in his departure. But on being assured that there could be no uncertainty about the definite promise of the Queen, he retraced his steps to Granada. The long, weary years of waiting and hoping were over, and the time for action had come.







## CHAPTER V.

### THE GREAT VOYAGE.



WHEN once Queen Isabella had resolved to favour the project of Columbus, no difficulties raised by her husband or by economists were allowed to stand in the way. The circumstances that the town of Palos had been condemned to furnish two ships for the royal service favoured what must have been Columbus's own desire that the expedition should sail thence. We have no space to dwell on the difficulties raised by the terror of the inhabitants when the nature of the enterprise became known. Suffice it that, after several months' delay, the little fleet was ready by the end of July, 1492, and on the 3rd of August set sail. The course as far as the Canaries was familiar. An accident to the rudder of one of the ships was, however, the cause of delay, and it was September 3rd before he finally set out.



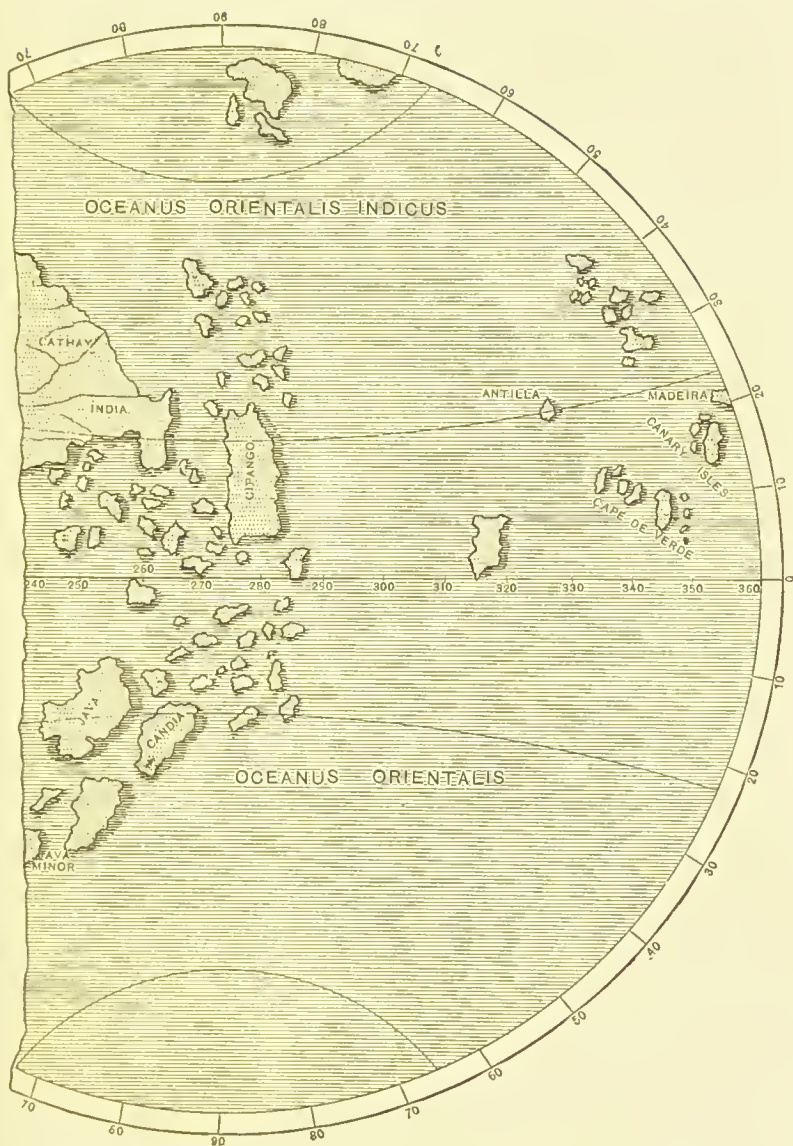
Never was sublime adventure attempted with instruments so mean! The whole fleet, if dismantled of masts and rigging, might have been packed in the hold of a modern liner of very ordinary size. Two of the vessels, called the *Pinta* and the *Nina*, were caravels—that is, undecked barges raised high at the prow and the stern, where alone shelter was provided for crew and officers in cabins little better than canal-boat accommodation at the present day. They were commanded by two brothers named Pinzon, who gave much trouble to Columbus because they were thinking much more of their own fortunes than of the success of the common enterprise.

The third vessel, the *Santa Maria*, on which the Admiral raised his flag, had at least the dignity of a deck. But the united tonnage of all three cannot have exceeded two hundred tons. In truth the great navigator himself had an inadequate idea of the nature of his task. He would have staked his life on the theory that on the other side of the ocean was India, with nothing but a few outlying islands between its riches and Spanish greed. The secret of this error lay in the inadequate ideas then prevailing as to the size of the world. Columbus believed its circumference to be some 16,000 miles, or about one-third less than the actual truth.

And in the 8,000 miles omitted from his calculation lay hidden and unimaginable the new world on which he blundered.

The map used in this voyage was in all probability similar to, if not identical with, the representation of the great ocean given by Martin Behem on a globe executed in this very year when Columbus sailed. It was in part based on the reports of Marco Polo, according to whom a great island called Cipango, commonly identified with Japan, stood out as an advanced guard from the Asiatic coast. That island Columbus believed to lie in the same latitude as the Canaries. And, making allowance for a considerable extension of Asia eastwards beyond the geographical knowledge of the time, he calculated that a voyage of 700 to 750 leagues due west from the Canaries should bring him to the coast of Cipango.

If the distance had proved double it would not have discouraged him nor blurred the clearness of his conviction. But with his crews the case was different. Even *his* estimates would have seemed to them an enormous, if not impossible voyage; while, should it be much exceeded, mutiny or madness might be inevitable. Under these circumstances Columbus determined to keep his own counsel and bear his tremendous burden absolutely



Portion of a Globe by Martin Behem, 1492.

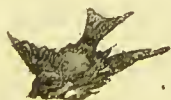
alone. He kept a log or journal, in which he set down accurately the distances run and the observations made each day. But this he determined no other eyes should see until it was laid before his sovereign's. On the other hand, the distances he furnished for the ship's log were designedly falsified, and made as much less than the actual fact as he dared to impose upon the practical skill and experience of his companions.

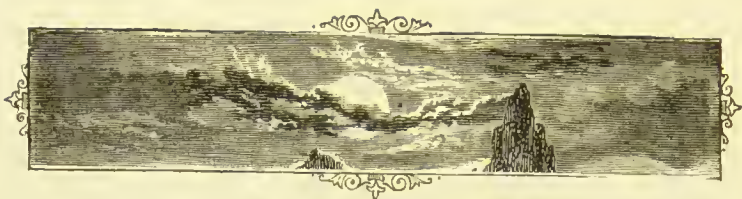
Happily, the sea was unwontedly calm. Indeed, at first the adventurers were fretted by the want of a breeze. For three days after leaving the Canaries they were only nine leagues west of Ferro, the south-western island of the group. But on that day, Sunday, September 9th, they finally lost sight of the known world, and every new horizon that rose upon them was a hope that daily changed to terror.

And now, every sign in air or sky or sea began to be scrutinized with an intensity of interest never felt near familiar shores. Objects that could be recognised, such as wreckage, broken masts, or planks of European vessels, were met with fear, as omens of the fate in store for irreverent intrusiveness into nature's secrets. Strange objects, such as unknown birds or fish, or carved implements of mysterious workmanship were seen with interest,



hope, or terror, according to the mood of the moment. At six days from the Canaries a great mass came floating by in melancholy helplessness, a token perhaps of human weakness overwhelmed in the waste of waters. Next day, amazement!—the magnetic needle, already a poetic type of faithfulness, has swerved from its allegiance, and points no longer due north as marked by the pole star, but slightly to the west. This is a serious matter, and it requires all the moral weight of the Admiral's renown for learning, and all the charm of his grave earnestness, to allay the fears aroused. He must frame a theory on the spur of the moment, that the magnetic pole is not the north star, but a point round which the star itself revolves. This serves its purpose for the time; but two days afterwards comes another portent: a great star, comparable to that flaming "Wormwood" spoken of in the Book of Revelation, flies burning across the sky, and falls, some say with audible hiss and splutter, into the sea. Surely it is like the flaming sword set at the gates of Eden, a warning against rash intrusion into forbidden realms.





## CHAPTER VI.

### THE DISCOVERY.

**N**EXT day, Sunday, the 16th of September, the smooth and sluggish sea is green with strange herbage, long tough stalks strong as cables, and prodigious fronds, tangled and woven together like a net of destruction. It yields indeed to the advancing prows driven on by the invariable easterly wind. But who knows whether this is not the guile of deceitful demons luring on their prey to certain capture? At any rate it seems clear that the adventurers are coming to the end of the navigable ocean, and all beyond may be formless waste, neither land nor water. No shoal nor sunken rocks can account for this ominous wonder. It stretches west and south and north, far as eyes can reach, an archipelago of unsubstantial isles, with a treacherous labyrinth of water lanes between. Now, first, coward fears

begin to suggest the desperate resort of mutiny ; but the calm self-confidence of legitimate authority holds as by a spell the passions of discordant weakness, and though the sailors muster in groups apart, they still sullenly obey the word of command. Fortunately another, and a favourable sign, appears in heaven, which the quick tact of the Admiral seizes on to distract attention. Far up overhead is a flight of birds winging their way to some place of rest. But behold, they are not seeking the European shores. They pursue the setting sun. They know the secret of the west ; and where winged earthly creatures have gone, there winged ships can follow.

The amazing progress made in acquaintance with nature during the last two centuries has familiarised us with the fact that the Sargasso Sea is the neutral region round which the equatorial current and the Gulf Stream keep up their perpetual circuit of movement. And just as leaves and sticks brought down at distant intervals by a river collect in a mass at the dead centre of a side eddy, so the floating uprooted wrack scattered over the Atlantic becomes concentrated in this central area. But though the phenomenon is so familiar and simple to us now, we must be singularly wanting in imaginative sympathy for past

times if we do not feel how well calculated such an appearance was to rouse the fears of superstitious sailors in the fifteenth century.

Those terrors being allayed, the men began to be as rash in assurance as they had been in despair. A pension of 10,000 maravedis\* had been promised by the King and Queen to the man who should first see land; and when the tokens of their approach to it were perceptible, every one who saw a solid cloud on the horizon sang out, "Land ho!" lest he should be anticipated. In the end Columbus had to lay down the severe condition, that any one who made this joyful announcement should be deprived of all chance afterwards if it did not prove true within three days.

Six days more passed, and gloom began to gather on all faces once more. The Admiral had refused to alter his course at the suggestion of some who thought they saw indications of land to north or south; yet all the signs by which he had encouraged them to persevere were proving delusive. If they went on much farther, the very possibility of return would be doubtful, if indeed it were not so already. The wind blew almost continuously from the east, and even if they could

\* A Spanish coin worth rather less than a farthing. Ten thousand would be about £10.



make head against it, there was the danger that their provisions would not hold out. Such perils increased in a rapidly growing ratio. Every league they went farther from home would be like two leagues on their return. Every day's food consumed was so much taken from their resources for the conflict against contrary winds on their return journey. The calmness of the weather gave little to do, and the gloomy groups that lounged about the decks incited one another to open mutiny.

There is scarcely a crisis in all secular history more tragic in its intensity of interest than the fortnight that yet remained of this heroic voyage. The Pinzons were never really loyal to their leader, and it is very likely he knew already how little he could depend upon them ; and there seems to be no record of any one else whose sympathy might have strengthened his hands. But this man faced his fate without a quiver in the enduring tenacity of his purpose. "Yes," he said, when the muttering grew too loud to remain unanswered, "yes, you can cast me into the sea. I do not fear death, for I have long been prepared for it. But how will it be with you, when you reach Spain again, and your crime stands revealed before their Majesties, whose commission you have outraged?"

Then seeing, or rather feeling the impression made by the power of an imperturbable will, he changed his tone, and urged with exhaustless patience and inspiring earnestness the multiplied signs of land. Fortunately about the same time the wind veered a little to the south-west, giving a hope of favourable breezes on the return. The crews resumed their obedience and the days went slowly on.

On October 1st the pilot of the *Santa María* made out that he had run 578 leagues from Ferro. With great composure the Admiral suggested that the truer figure would be six leagues more than the pilot allowed, or 584. This did not look as if their leader wished to underestimate the distance. No, they would all say, the Admiral was at least candid; he did not wish to disguise their real position; he had even corrected the mistake of the pilot, which would have made them six leagues nearer home than they really were. Yet all the while Columbus knew, and noted in his private diary, that the real distance they had run was not 584 leagues, but 707.

At length, as the evening flight of birds appeared to be uniformly toward the south-west, Columbus allowed the course to be altered in that direction, saying it could make little difference now. But when day after day still went by and no land was

seen, the spirit of mutiny revived once more, and on the 10th of October it came to a head. This time the men did not wait for their discontent to be interpreted. They cried aloud that they would have no more of this impious obstinacy. They had suffered enough through one man's insane conceit; there must be an end to this, the ships' heads must be put about, and would to God they might escape the consequences of rash hardness! In this extremity it is said that Columbus made a treaty with his crews for three days more, promising that if land were not discovered by that time he would yield. But there is no evidence for this, and it is utterly unlike the man. He had no more notion of turning back toward the east than had the sun over his head. On the contrary, he explained to the men once more the nature of his calculations, which had not yet been falsified. They had not yet run 750 leagues, and therefore could not expect to see Cipango. But floating herbage and land birds, and even scents in the air, assured them that they were in the neighbourhood of islands. And whether or not, whether he was right or wrong, they had no choice in the matter; necessity was laid upon them, and they *must* go on discovering those Indies to which their Catholic Majesties had sent them.

At length on October 11th the tantalising tokens of land assumed such a form that it was impossible even for cowardice to dispute them. Moved by these omens of near triumph, Columbus collected his men and announced the speedy end of their labours. They had now at last arrived, he said, precisely where, according to his original calculations, Cipango or its outlying islands might be looked for. Henceforward they would take in sail at night, and proceed with caution. Further to invite watchfulness, he announced that, in addition to the pension promised by the sovereigns, he himself would give a prize to the man who should first sight land. It is a curious illustration of the manners of the times that the reward was to be a velvet doublet, or, as we should say, waistcoat. The prizes of plush breeches given even within the last fifty years to virtuous agricultural labourers in England were evidently, like many other things in our rural districts, survivals from a half-barbarous past.

And now for the last time the sun goes down into a realm of intangible mystery ; but there is no sleep for eyes that are kindled with the fever of an intolerable suspense. So the Admiral takes post in the deck house on the poop, where he can sweep the forward horizon with his craving glance.

Soft ! there, low down in the dimness between sea and sky—what is that ? As God lives it is a light, a light ; it cannot be a star ! It is not diamond-like as God's stars, it is ragged and flickering like every light of human kindling. Alas ! it is gone. It was an illusion of an overwrought brain. No, there it comes again ; it moves, it waves, it is a torch-light upon some shore. Trembling with a joy not yet certain of itself, the Admiral calls softly to an officer on deck, Pedro Gutieres by name. The officer mounts the poop, looks in the direction indicated, and after an instant sees the spark. God be praised ! it must be a light on land. It comes and goes, it rises and falls, as though it were a torch in some fisherman's boat, or carried by hand from house to house on the shore. Another comrade is called, but when he mounts to the post of observation the light can be seen by no one, and it reappears no more. In these strange regions even the senses cannot be trusted on evidence so evanescent. But hark ! a gun booms from the *Pinta* on in front. She stays her cautious course. She lies to ; she has seen the land. The weary days of suspense are past, and an unknown world waits the unveiling of the dawn.





## CHAPTER VII.

### THE NEW WORLD.



WHEN morning rose, on Friday, October 12, 1492, the scene served rather to excite than to gratify curiosity. Columbus saw before him a low, flat island, some fifteen miles long, clothed everywhere with strange luxuriant foliage. From the woods along the shore groups of men, women, and children came running to the waterside, where they stood, gazing in evident perturbation and amazement. So far as could be observed they were of a race never seen before. That they were barbarous was clear, for they had not a stitch of clothing amongst them; but whether friendly or hostile, could only be ascertained by experiment. Arrangements were speedily made to put them to the proof. A landing was effected with imposing show of scarlet and gold and flashing armour.



The Landing.

The Admiral knelt and devoutly kissed the soil. Then with blare of trumpets astounding to the natives, possession was taken in the names of their Catholic Majesties. According to some the *Te Deum* was chanted; and in ignorance of the musical native name, Guanahari, the island was christened San Salvador. The inhabitants, terrified by sights and sounds so unwonted, quickly disappeared in the thickets. But after a while they acquired confidence, and Columbus endeavoured by the language of signs to gain some information from them. His first object was to find the gold regions of the Indies, of which he now believed himself to be in the immediate neighbourhood. According to his information, numerous islands, the abodes of savages, abounded off the eastern coast of Asia, and therefore what he saw quite coincided with his anticipations.

Imagining himself therefore to be amongst the archipelago depicted on Behem's globe, he was anxious to find his way to Cipango before seeking the mainland of India. Therefore, taking some natives on board who might be trained to act as interpreters, he cruised from island to island until, on the coast of Cuba, he supposed himself to have reached the continent of Asia. Here, whether by accident or design, one of the Pinzons parted from



him, and was not seen again until the eve of the return voyage. There is too much reason for concluding that he wished to separate himself from the fortunes of Columbus, and to magnify himself at the expense of his leader.

Meanwhile stress of weather drove the expedition from Cuba, and still always in pursuit of gold first, and the Grand Khan or Chinese Emperor as his final aim, the discoverer was brought to the shores of Hayti. Here the *Santa Maria* was wrecked through the carelessness of a steersman, and thus Columbus, deserted by the *Pinta*, was left with only one caravel, the *Nina*, measuring probably some thirty or forty tons, to bear the whole burden of his discovery across the wintry ocean. He sailed away at the beginning of January, 1493, purposing to investigate the southern region, and then stretch across at a lower latitude than on his outward voyage. He had not quitted Hayti, or, as he called it, Hispaniola, when the treacherous Pinzon was descried in pursuit of his own fortune. He excused himself by difficulties of weather, and the Admiral was not in a position to assume a haughty tone of reproach. So in company they visited some of the islands of the Caribs, of whose savage fame Columbus had learned much by ominous signs or awestruck



gestures of the more peaceful natives. Then taking advantage of a favourable wind, which, however, did not carry him far, he swept out into the Atlantic, and began a deadly struggle with wind and waves, which lasted for six weeks before the Azores were sighted.

Here the hostility of the Portuguese commander occasioned much trouble and delay, and it was the 4th of March before the mainland of Europe was once more sighted. Obligated to land at the mouth of the Tagus, Columbus was again exposed to difficulty and even danger through the jealousy of the Portuguese. But his tact and firmness stood him in good stead, and at length, on the 15th of March, he re-entered, as the triumphant bearer of astounding news, that harbour of Palos which, nearly eight months before, he had left amidst the lamentations and curses of the people. Pinzon, who had again parted from him on the homeward voyage, is said to have sailed up the harbour on the evening of the very same day, believing himself to be the surviving commander of the expedition. As he came near he heard the bells ringing out joyous peals, and soon saw the irrepressible *Nina* resting safely at anchor. His disappointment and the reproaches of the sovereigns are said to have been the cause of his death.



## CHAPTER VIII.

### THE DISCOVERER'S REWARD.



URING the next few months Columbus might have meditated with satisfaction on the proverb—if it exists in Spanish—that “nothing succeeds like success.” His progress to the court was a triumphal procession ; his reception was that of a conquering general. But the high summer of his fame was of brief duration. Before the autumn of the year was far advanced he set sail again with a large fleet, strong enough, as was supposed, to seal the fate of the newly discovered lands.

In the second voyage a colony was founded in Hispaniola, many new islands of the Caribbean Archipelago were discovered, notably Jamaica, but the mainland of America was yet untouched.

The discontent of the colony he had founded and the intrigues of selfishness led to the recall of Columbus in 1496. He was received, however,

with favour, though familiarity had dimmed the marvel of his successes, and like many another benefactor of mankind, he found that the failure to realise impossible dreams had almost neutralized the credit of substantial services. After long delays and many disappointments he was enabled to set sail with his third expedition in the early summer. In this voyage, taking a more southerly course, he touched the mainland of the South American Continent in the district of Paria, north of the delta of the Orinoco. But he had no idea of the nature of his discovery. Misled by his preconceived notions, he believed himself still to be off the coast of Asia.

On his arrival at Hispaniola, after more than two years' absence, he found that things had gone from bad to worse. Cruel oppression of the natives, and consequent murder and massacre, had been aggravated by conflicts amongst the colonists themselves. Distracted by the difficulties of restoring order, the Admiral appealed to Spain for aid ; but his opponents managed to obtain the ear of the court, and the result was his supersession by a new viceroy, who, in the year 1500, arrived armed with full powers. This man, Francisco de Bobadilla, was by nature a mere vulgar bully, to whom it was an exquisite delight to humiliate one so

conspicuous in the eyes of the world as the great Admiral. Not content with ostentatiously deposing him and reversing his judgments on Spanish mutineers, he arrested Columbus, bound him in fetters, and sent him on board ship to be deported as a criminal to Spain.

Then shone forth the moral dignity of a nature, unfit indeed for the distracting details of statecraft, but supreme in every hour of heroic action or suffering. He uttered no word of complaint, still less of entreaty. Instinctively realising the actual state of the case, he was convinced that this violence was the petty bravado of a Jack-in-office, and would produce an indignant revulsion of feeling in Spain. He readily complied with a request of the petty tyrant that he would use his moral influence to secure the obedience of his adherents to their Majesties' commands. On the voyage the commander of the vessel offered to remove his fetters. "No," said Columbus, "they shall not be taken off, but by direct orders of the King and Queen; and then I will preserve them afterwards as memorials of the reward my services have met." And he kept his word; for they were hung up in his cabinet till his death; and when he felt that approaching, he requested that they might be buried with him in his grave.



Events happened as he knew they must. The Queen almost wept with indignation when she heard how her knightly sailor had arrived in chains. The accusations against him were contemptuously ignored. He was received with all honours at the court, and the cowardly ruffian who had so insulted him was superseded and recalled. At the age of sixty-six years, enfeebled by the exposure and anxieties he had undergone, tormented by gout and depressed by the disappointment of his passionate desire to reach India through the west, his natural force was yet so unabated that he undertook with confidence a final voyage, in which he was resolved to break through the tangle of islands and reach the coasts of the Grand Khan.

Passing by some rather remarkable adventures on the way, we find him, at the beginning of August, 1502, on the isle of Guanaja, or Bonacca, off the coast of Honduras. Here he heard accounts of Yucatan, such as should have determined him to sail westwards. Unfortunately, he was deluded by the hope of finding a strait leading towards India, and the mistaken choice of his direction now made of his last years a stormy evening instead of a splendid sunset. He attempted to found a settlement on the Isthmus, an



attempt which resulted in failure, and sanguinary battles fatal to a large number of his people. Leaving, after many disasters, he crept with leaking ships and demoralized crews towards his new-world home in Hispaniola. But off the northern coast of Jamaica he was obliged to run both his vessels on shore, as they were in a sinking condition ; and there, half covered by the tide, they formed the foundation for a novel kind of fortress constructed after the fashion of the ancient lake-dwellings. Houses of shelter were constructed on the decks. Simple fortifications were sufficient to guard against surprise ; and if the crews had been in good discipline the Crusoe life they led would have been fairly tolerable for all except Columbus himself, who suffered tortures from gout.

One brave man set off for Hispaniola in a native canoe ; but as eight months elapsed before anything was heard of him, it appeared only too probable that he had been lost at sea. Meanwhile, the crews left with the sick and weary Admiral broke into mutiny and threatened his life, but his presence of mind and resolution never deserted him. He sprang out of his cabin to confront them, but he tottered like a helpless infant, and the few loyal men had to bear him back in their arms. The mutineers then took what boats there were,



and attempted to make their way to Hispaniola ; but failing in this they lived a marauding life on the shore, until at last they were subdued in a pitched battle by Don Bartholomew, the brother of Columbus, and a number of faithful followers. After a full year of this misery, which might have been shortened by half but for the scandalous neglect of the new governor of Hispaniola, relief at length came ; and after a short stay in the colony the Admiral departed finally for Spain, where he arrived toward the end of 1504.

There are some rivers whose only grandeur is in their outflow to the sea ; so is it with men in whom a sublime death redeems an unprofitable life. There are other rivers which, after flowing with a strenuous current and dashing over glorious falls, subside into a dreary plain where they meekly soak into the ocean ; so is it with some lives, and that of Columbus was one of them. The same spiritual force was in him as of old, the same courage, the same high honour ; but the circumstances were adverse. His last year ran through flats of respectful neglect. The King, now bereaved of his bright-souled wife, was troubled in spirit when he thought of the terms he had granted Columbus, and the enormous significance they seemed likely to have. He wished to effect a



compromise, but Columbus would not listen to it. The infirm old man showed his proud susceptibility to the last. "I hold to all that concerns my honour," he said; "as to anything else, your Majesty may do just what is best for your own interests." But the controversy remained unsettled, and in May, 1506, at seventy years of age, he carried it to the court of Heaven. Remembering how little faithfulness he had found amongst the great ones of this world, there was perhaps a special significance in the pious phrase with which he surrendered life: "Lord, into thy hands I commit my spirit."

It is a foolish motto which was inscribed upon his grave, "To Castille and Leon Columbus gave a new world." So every little peninsula or island arrogates to itself the rights and blessing conferred by Heaven upon mankind at large. Castille and Leon, whatever their imperial ambition, were too small to rule the tide of new discovery and storm of enterprise that followed the achievement of Columbus. The veil being once lifted from the mysterious ocean, the energies of a civilisation confined within limits far too narrow for its expansive forces, broke forth with startling vigour.

In the year 1497 Sebastian Cabot, sailing from Bristol, discovered the whole coast of the North

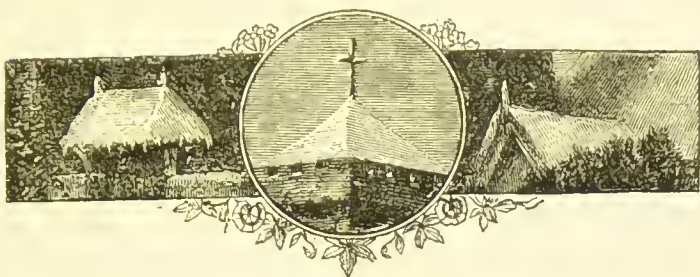
American continent from Labrador to Florida. In the same year Vasco de Gama passed the Cape of Good Hope and opened the first ocean path to India. About the same time several voyagers, both Spanish and Portuguese, followed the coast of South America for many hundreds of miles, and in some of these expeditions Amerigo Vespuccio, who, by a singular caprice of fortune, gave his own name to the new world, took part as a mere subordinate. It was by a facile pen rather than by any achievements of discovery, that he obtained this undeserved renown. But fame secured only by words and names shrivels into nothingness in the growth of a history that absorbs only facts into its substance; and in the enormous development of human resource, activity, and thought, attributable to the widened area of civilised life and to the reaction of the New World on the Old, the fictitious fame of Vespuccio has sunk into an obscure question of curious research, while the heroism of the true discoverer fills both hemispheres with its immortal renown.

And well it may. Think of what those new lands have been to us—the refuge of persecuted truth, the asylum of oppressed freedom, the breath of life to millions who in the dense struggle for existence here must have perished. Think of the

favourable circumstances under which new political experiments have there been tried, of the impulse given to inventive genius by the preciousness of labour amid the vast area to be subdued. Think of the tide of wealth which has thence recoiled upon our shores, wealth not so vulgar as the treasures craved by Spanish greed, but wealth of experience, wealth of knowledge, wealth of power, wealth of enlarged life ; and we must acknowledge the truth of the first words with which we began our story, that there is no record in history of any achievement by an individual man which can be compared in the enormous sweep of its results with the Discovery of America.



Statue of Columbus at Madrid.



# FRIAR BACON.

---

## CHAPTER I.

### AGES OF HEROISM.



ALMOST every boy who has made any progress in study, rejoices at times that he was born in the nineteenth century. He hears his grandfather and even his father say how different the world was in their early days. They tell him how rapidly steam and railways and telegraphs have spread through all civilised nations, and have even astonished the savages of Africa and the half-barbarous tribes of Asia. At the beginning of this century the inhabitants of any northern English county looked on a journey to London as a great and even dangerous adventure ; while now, men



of very moderate wealth make holiday excursions across the Atlantic. Schools, libraries, and newspapers have been established by hundreds and thousands within the last fifty years. And now every household in Great Britain can read at breakfast what all the rest of the world was doing on the previous day.

Yes, it is a fine thing to be born in this age of progress. But railways and telegraphs are not everything. If the young could but understand it, what we really are in ourselves is of more consequence than what we do. Of course "actions speak louder than words," and much louder than thoughts. It is equally true that character can only be proved by conduct. But when conduct is difficult, more force of character is necessary to keep it right. And actions which are a mere matter of course in easy times may require the greatest heroism in darker days. A well-fed and well-clothed child needs little courage or devotion to take his books and travel to school by rail or omnibus. Everything is made easy for him when he appears in his class, to be taught by a kind teacher trained to take all trouble upon himself and save his pupils as much as possible.

But picture a boy born in a rural village in England during the "dark ages." There might

be no school within twenty or thirty miles. He might live to manhood without ever seeing a book, except in the hands of the priest at church. If he wanted to learn to read, the neighbours would treat him as a conceited upstart. And as the country was half savage, the greater part of it covered by woods, bogs, and wild heaths, it was difficult and dangerous for him to move about in pursuit of knowledge. In such circumstances a boy might show more heroism in learning to read and write than his descendant does in mastering Greek and Latin and French and mathematics. Thus, it is not quite certain that the great progress of our time helps to develop character. There is a more general diffusion of knowledge; but the few who attained it in old times had to make greater sacrifices than we have, and it is just such sacrifices that bring out nobility of nature.





## CHAPTER II.

BORN BEFORE HIS TIME.

**I**N these times a youth of Roger Bacon's genius—if for a moment we may imagine such a miracle repeated—would almost certainly look round him for the best market. And if he had the advantages of social position that were not wanting in Bacon's case, there would probably be a keen competition for the honour of introducing him to life. Exhibitions, honours, wranglerships, fellowships, would invite his acceptance. And friends in high position, proud to be consulted, would carefully weigh the openings and the advantages promised by the church, the bar, the laboratory, or the professor's chair. All this is very pleasant to modern genius. But it may be doubted how far it is conducive to the disinterested devotion without which genius lacks the inspiration of character.

Very different was the outset of Roger Bacon's career. He was born about the year 1214, in Somersetshire; the precise spot is unknown. His family had a good social position; and one of them, probably his uncle, ranked high in the world of intellect. This was Robert Bacon, commonly called Big-head (*Grosse-tête*); a name that is suggestive, for his great head probably held a good deal of knowledge. Where the boy received his elementary education we do not know. But he entered Merton College, Oxford, at an early age, most probably under the patronage of his relative, who held a high position in the university. Of prizes won, of honours attained we hear nothing. If there were any class lists in those days there were no newspapers to publish them, and no public to appreciate them. But silence is very eloquent if there be only some bright scintillations of fact to give it a meaning. And knowing what the man was, from the mighty works left behind him, we find it most pathetic to think that long years after these boyish studies, when he was approaching forty years of age, he was still casting about for some recognised position.

Meantime he had spent some years at the University of Paris, but whether as a simple student or



as a professor, is unknown. He is said to have attained great popularity among the students of the time by the acuteness of his observations and the boldness of his ideas. But neither his acuteness nor his boldness was of the type required for the only lucrative callings of the time, the Church and the army. The acuteness desired by the Church of that day was a quality available for ecclesiastical intrigues and word-chopping. But Bacon's was principally shown in his quick perception of the bearing of natural facts. The boldness most needed was shown in brutal violence. But Bacon's was shown in unmasking false authorities. And so it came to pass that at an age nearer forty than thirty he had no permanent calling, and no recognised place in the world. But this defect arose from no impracticability, nor from any want of fixity of purpose. It resulted simply from the novelty of aims incomprehensible to his time. The long years of waiting were not wasted. He was an earnest student all the while. He read not only the narrow library of established authorities, but all accessible books, whether from Greek, Hebrew, or Arabic sources.



## CHAPTER III.

### A MISTAKE IN LIFE.



OR an extensive range of study Bacon had peculiar advantages, if at least we are right, as seems probable, in identifying Robert Grosse-tête with his uncle. This Robert was a great collector of books, and was among the first of Western scholars to appreciate the treasures of learning yet locked up in Greek and Saracen libraries. The new world to which Roger was thus introduced showed a diversity of opinion and independence of judgment very different from the stereotyped uniformity that had for centuries paralyzed both science and literature in the West; and it was perhaps the very discord of the ancients which drove him to insist upon the pre-eminent importance of experience and of fact. In the assertion of this principle he anticipated by three centuries his great namesake Lord Bacon; and certainly he made a much better use of it himself.

Such was the man who at nearly forty years of age was yet neither soldier nor priest, lawyer nor courtier, without any standing in the world, or so far as we know, any official position in the university. But he had already set his heart, not so much on an ambition as an aspiration, compared with which the highest worldly hopes were poor. He wanted to see knowledge emancipated from false authorities, and the progress of discovery freed from the blockade of prejudice. That he anticipated the actual result—suspicion, misrepresentation, persecution, life-long suffering, and an unhonoured grave—we do not suppose. He calculated neither what he should gain nor what he should lose. He thought only of the glory of God's works, of men's petty misconceptions, and of the larger life that would be given to mankind if those works were better understood.

One proof that his life was animated by aspiration rather than ambition is the humility with which his own achievements were subordinated to those of others. It is a remarkable thing that in his writings he makes little or no reference to contemporary names that became famous. The men that kindle his enthusiasm are almost entirely unknown, except through his mention of them. But on that very account his references to them

are all the more touching. For instance, there was a certain "Master Peter," probably the author of an obscure treatise on the magnet, of whom he speaks in terms that make us wish we knew more about the man. "He is," says Bacon, "the only man capable of hastening on the advance of knowledge. He hides himself in his retirement. He will have neither pupils nor admirers. But he is the one man of this age who has realised how essential it is to study nature by experience and observation. His mechanical inventions, his discoveries in physics, in chemistry, in metallurgy, have put him in possession of several wonderful secrets. On the day when he pleases to divulge them he will be overwhelmed with honours and wealth." These are remarkable words in more respects than one, and especially so for the innocent ignorance of the world they show in a man who at the time of writing must have been past middle life. Alas! he found that it is not so easy to make the world understand great discoveries; and from a worldly point of view "Master Peter" was probably a wiser man. But after all, what strikes us most in the passage is its humility, and the grand unconsciousness of genius. His heart was set on the emancipation of knowledge. But he was only a lowly helper of others greater than himself.



## CHAPTER IV.

### BANISHMENT AND IMPRISONMENT.



NOW was the heroic student to fulfil even the humble mission he claimed? There was no public opinion to appeal to—at least as we understand the phrase in these times. Official position, or the protection of great persons, or the power of corporations—such were the conditions, one or other of which much be secured, in order to give an individual voice any chance of being heard. Now Bacon had not taken the right course to secure any official position. Officials did not seek out unworldly students then; and they very rarely do so now. Kings, popes, and bishops, though occasionally disposed to amuse their moments of leisure with the patronage of learning, had little time for such relaxations in the rough-and-tumble life of that age. There remained only the shadow of a great corporation. It is difficult



to understand why Roger delayed so long his choice of this ; and still more difficult to conceive why, after so long a delay, he made so bad a choice, and thereby destroyed every chance of happiness or peace in pursuit of his vocation.

As to the first point, it is possible that the friends of his early days—notably Robert Bacon and Edmund Rich, of whom the latter became Archbishop of Canterbury—were a sufficient protection, until, as is the habit of friends, they dropped away by death or change of circumstances. But why, when he found it necessary to enter a religious order, he should have made choice of the Franciscans, is a question far more difficult to answer. The Benedictines are justly celebrated for their services to literature. The Dominicans were not averse to study ; but the Franciscans imposed a severe rule, according to which poverty, formal prayer, fasting, and manual labour, comprehended the whole duty of man. It is not impossible that their professions of purity attracted Bacon's unworldly mind ; but he found that their ideas on this subject were very different from that of the apostle, who said, "To the pure all things are pure." The purity they professed sprang not from self-forgetful faith, but from the arbitrary exclusiveness of spiritual pride, and it was,

therefore, a natural ally of injustice, intolerance, and bigotry.

For a short time Bacon pursued his studies in peace. He was even allowed to occupy a tower detached from the monastery at Oxford, and convenient for the purposes of an observatory. He communicated his enthusiasm to a few of the younger brethren, and employed them in preparing tables that were needed for his calculations. But, as was natural in a society of narrow minds, this association excited jealousy; and complaints of Bacon's frivolous pursuits were made to the superiors of the order.

The general of the Franciscans was at that time Giovanni Fidanza, better known as Saint Buonaventura, a man whose mystic piety commands respect. But at a distance, and incapacitated as he was both by nature and habit for understanding Bacon's object, he could hardly be expected to detect the malice of the misrepresentation made to him. Accordingly he passed upon the poor student a sentence of banishment and imprisonment. He ordered his removal to a monastery in Paris, where the conditions of his confinement were such that the loss of sympathizing friends could not be compensated by access to the university, where he was already known.

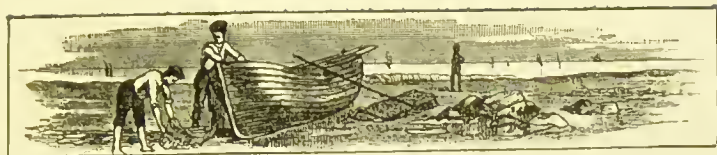




Bacon felt very bitterly the deprivation of all the instruments and materials for research that he had gathered around him in his Oxford retreat, and even worse was the parting from pupils whom he had inspired. One of these, Thomas Bungey, had made such progress in mathematics as to be of great service to him. But the closer the friendship, the more anxious was misguided authority to sever it. "He must live shut out from the world," said the fatal order of the general, "separated from all his friends, imprisoned in a cloister. He has a brother who, like himself, is a man of science; he has disciples who wait upon his instructions; he can do them no good. For him, his lot must be confinement on bread and water and the confiscation of any manuscript that he may try to smuggle away." Hardly a more dismal fate can be imagined for an enthusiast with the aspiration of Roger Bacon. But, happily, it was not very long before a sudden ray of startling hope brightened the deadly gloom.







## CHAPTER V.

### WORK AND HOPE.



AMONG the ambitious ecclesiastics of the time was one Guido Fulcodi, whose life up to middle age had been divided between the intrigues of courts and the adventures of war. His highest secular advancement was the post of secretary to Louis IX. of France. He seems, however, to have envied the more brilliant rewards offered to ambition by an ecclesiastical career; and when the death of his wife removed the only obstacle to his entering the Church, he took orders. Being a man of promising abilities, as well as backed by enormous influence, he was rapidly promoted, and soon became a person of European consideration. He seems to have been a man of liberal views and to have already been attracted by the solemn dawn of a grander light appearing on the horizon of the dark ages.

While Bacon was still surveying the heavens

from his tower in Oxford, this powerful ecclesiastic heard strange stories of his mysterious skill, and he desired to make his acquaintance. It was impossible, however, that the two men should be brought into personal contact, and the only result was a correspondence, in which Fulcodi expressed a wish that Bacon should embody the substance of his observations and discoveries in a book. But before this could be done the poor monk was a close prisoner in Paris, deprived not only of instruments of observation, but even of the means of writing. To do Fulcodi justice, he did not forget his poor correspondent. He wrote to him some words of consolation and encouragement — which, however, were never delivered; and Bacon, in the bitterness of his heart, felt as though he were forsaken both by God and man.

What, then, must have been the revulsion of hope within him when the news was first whispered at the door of his cell that Guido Fulcodi had become the Pope Clement IV. ! True, it appeared as though his exalted friend had ceased to think of him; but then he might have been prevented by many difficulties which would disappear before the omnipotence of a Pope. Bacon therefore wrote, with what tremblings of heart we may

easily imagine, a congratulatory epistle, in which he ventured to remind the Pontiff of their previous correspondence. A year passed away without any reply. But in those times men were accustomed to sleep and rise oftener between the dispatch of a letter and the arrival of the answer, than between the sowing of the seed and the reaping of the harvest. In the second year the answer came—an answer that surpassed all expectations. Heartily recognising their past relations, the Pope ordered Bacon, on his allegiance, notwithstanding any prohibition by lower authority, to write the work that had formerly been desired, and to send it to Rome. “We desire in addition,” said the missive, “that you should explain in your letters what are your ideas of the remedies we ought to apply to an evil” (meaning the blockade of knowledge) “in your opinion so dangerous.”

Unfortunately the Pope had forgotten two almost essential conditions of Bacon’s obedience. The one was an official and authoritative order such as the superiors of the convent could not have disobeyed; and the other was a supply of money for inevitable expenses. In consequence of his neglect on the first point, Bacon was subjected to still severer restrictions, of which he complained in vain. There was in the monastery

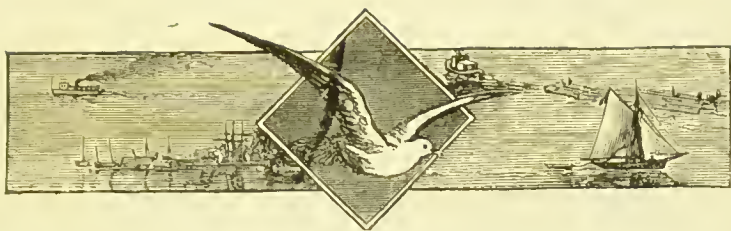
a young friar whose mind had been awakened to sympathy with his pursuits, and whom he hoped to make his messenger to Rome. But such was the jealousy of the superiors that the two men were obliged to resort to the secrecy of conspirators, and held their interviews in momentary dread of interruption and punishment. Again, through want of funds for instruments, books, and assistance, the commencement of the work was long delayed.

At last, by almost abject mendicancy, some sixty pounds sterling were scraped together. Bacon set himself to work in earnest. His principal book, the "Opus Majus,"\* consisting of four hundred and seventy-seven folio pages, was written in less than a year. It was dispatched by the hands of the trusty friend who had been prepared for the work, and whose mission the superiors dared no longer prohibit. A supplementary work, the "Opus Minus,"† was immediately added, and a third manuscript was then commenced. There is no reason to doubt that the Pope highly appreciated the works of the imprisoned monk. But even *his* powers were not unlimited, and it was only after a considerable length of time that he thought it safe to send formal orders for the philosopher's release.

\* Greater work.

† Smaller work.





## CHAPTER VI.

### DEATH AND RESURRECTION.



WE may imagine the joy with which Bacon hastened back to his beloved Oxford and his tower of observation. But, alas! within a year Clement IV. died, and after an interregnum Gregory X. ascended the pontifical throne. Once more bigotry was triumphant. Bacon became the object of popular suspicion on account of alleged sorceries and magic. He was torn away once more from his studies, and imprisoned for several years. It is uncertain even whether he was at liberty at the period of his death. He was released from his second imprisonment by the order of a more liberal superior, but what became of him afterwards is not recorded, nor yet the place of his burial.

In the seventeenth century the "Famous Historie of Fryer Bacon" was a very popular little

book, which passed through many editions. We sit in the British Museum library, and amidst the ten thousand thousand potential voices of the past ranged around us on the shelves, we listen to this one alone. And listening to it, we sink back amidst the inconsequent fairy tales, the self-confident bigotries, the dark superstitions, that course with fitful light and shadow over an heroic age. We fancy ourselves by the fireside of some lonely farm, where in the winter evening the one scholar of the circle stumbles as best he can through the amusing story of "Fryer Bacon." We hear how, for the entertainment of the king, "the Fryer" waved his hand, and there appeared tables covered with the most costly luxuries; how at his beck mysterious music ravished all ears; how, at another sign, perfumes, as of the Garden of Eden, filled the air. We hear how this same wonder-working "Fryer" went to the aid of the King of France in an apparently hopeless siege, and by means of a mysterious instrument set the city in a flame. We hear how he boasted that he could make great ships to move across the sea without a single sail exposed to the wind and needing only one man to steer them; how he declared that "chariots might be made to move with an unspeakable force, without any living creature to stir them." And we

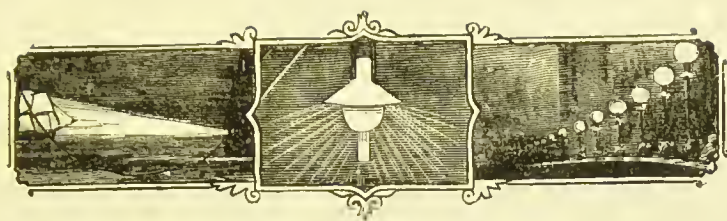
smile to think how the roguish monk deceived the simple ones of old by his pretended magic, unless indeed he really bewitched them by the arts of the devil. Such was the Roger Bacon of popular fancy, such indeed the only Roger Bacon known to the world for nearly five hundred years after his unhonoured death.

But what is this other great volume beside us, speaking in a deeper tone and from a farther past ? It is the soul-utterance of the man himself, and by it he, being dead, yet speaketh. Listen to him. "There are four chief hindrances," he says, "in the way of the comprehension of truth ; hindrances which hamper even every wise man, and scarcely allow any one to attain a true title to wisdom, namely : the standard of a weak and unworthy authority ; the persistency of custom ; the untrained senses of the common herd ; and the disguising of our proper ignorance by the display of a pretentious knowledge." And this last cause, he says, is the worst of all. "For there is no man so skilled in the nature of things, that he could undertake to speak with confidence concerning all the truths that are involved in the constitution and the powers of a single fly. He could not tell what are the true causes of its colours, nor why it has so many legs, no more and

no less; nor could he give any theory of its various parts."

Let this grand humility, this far-seeing prophetic insight into the approaching kingdom of truth, be contrasted with the buffoonery of the stories that for half a millennium were the only recollections retained by the world of one of its supremely greatest men. And if the reflections suggested have a tinge of bitterness, that bitterness is lost in the confirmation of our faith that no great soul does ever really strive or suffer in vain. It is said that on his death-bed Bacon exclaimed, in the anguish of his apparently lost labours, "I do repent me of having taken so much trouble for the progress of knowledge and of mankind." Let us not judge harshly these words of frail mortality. From the depth of a still diviner tragedy there issued once the cry, "My God, my God, why hast thou forsaken me?" Yet this cry was the prelude to the resurrection. And so is it for ever.





# GALILEO.

---

## CHAPTER I.

### HIS TIMES.



GALILEO belonged to a noble but impoverished family of Florence. The family name was really Buonajuti, but the pride which all members of it took in the illustrious distinction of an ancestor with the Christian name of Galileo led them to adopt this in its plural form, Galilei, as their surname. Hence the full name, Galileo Galilei. Not long previous to the great astronomer's birth, his father, in the vain pursuit of fortune, had removed to Pisa, where Galileo was born on February 15th, 1564. Returning to Florence, the father fell into continually greater



embarrassments as the expenses of his family increased. It was of the utmost importance that the young Galileo, being the eldest son, should follow some lucrative profession, which would enable him to assist his younger brothers and sisters. The profession chosen was that of medicine, and at sixteen years of age he was sent to Pisa to study at the university there. As in many other illustrious instances, however, his genius obstinately refused the attractions of money ; and his inclinations were irresistibly drawn to mathematical and physical pursuits. This was the cause of many domestic differences ; but his abilities soon became so manifest that he attracted the attention of men with influence at the court of the Grand Duke, and at the age of twenty-five obtained an appointment as mathematical professor.

It is necessary now to consider for a moment the state of astronomical science towards the end of the sixteenth century. The wonderful revival of learning, consequent on the dispersion of Greek literature over Western Europe after the capture of Constantinople by the Turks, had quickened the human intellect to advance on new paths of discovery undreamed of in the classical age ; and in the susceptibility to novelties thus excited, the revolutionary speculations of Copernicus as to the

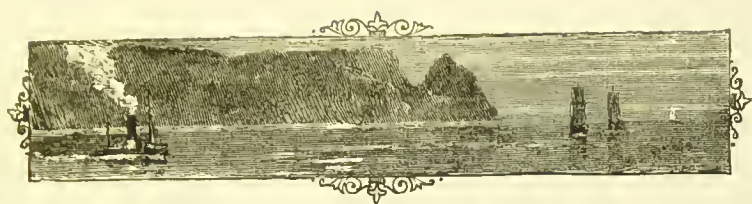
system of the physical universe had attracted the interest of all the most eager and the adhesion of the most daring souls. But the older, or Ptolemaic\* system, which regarded the earth as the centre of a number of concentric spheres, whose revolutions accounted for the visible movements of the stars, was regarded as not only palpably demonstrable to common sense, but also as essentially bound up with the authority of the Bible and the Church, and with the most sacred interests of morality and religion. To doubt the truth of this system was, in the view of the bigots of that day, to abjure Christianity and to make an open profession of atheism. So late as the year 1600 Jordano Bruno was burned alive at Rome for his obstinate adhesion to this heresy.

Nor were the difficulties of the position confined to dangers of persecution. Even the most learned men of the time, to say nothing of the masses of the people, showed a curious inability to appreciate the superiority of palpable and repeatedly verified facts to mere theories consecrated by antiquity. For instance, the disciples of the Aristotelian school of philosophy held that falling bodies must

\* So called from its author Ptolemy, who lived in the first century. His idea was that round the earth as a centre there were ranged at different distances a number of spheres whose motions at various distances accounted for the appearance of the heavens.

necessarily descend to the earth with a speed exactly proportioned to their weight. A mass of ten pounds must fall ten times as rapidly as one pound, and a hundred pounds in a like proportion. This seemed plausible and natural ; so much so indeed that, as far as we are aware, no one before Galileo had thought of trying by actual experiment whether this was really the case or not. The observations of the keen-eyed astronomer, however, led him to a different conclusion, and he was daring enough to proclaim it. So far, he maintained, was the great master from being right on this subject, that a weight of a ton and a weight of half an ounce would fall precisely the same distance in the same time, except so far as the resistance of the atmosphere might make a slight difference in favour of the heavier body.





## CHAPTER II.

### IS SEEING BELIEVING ?

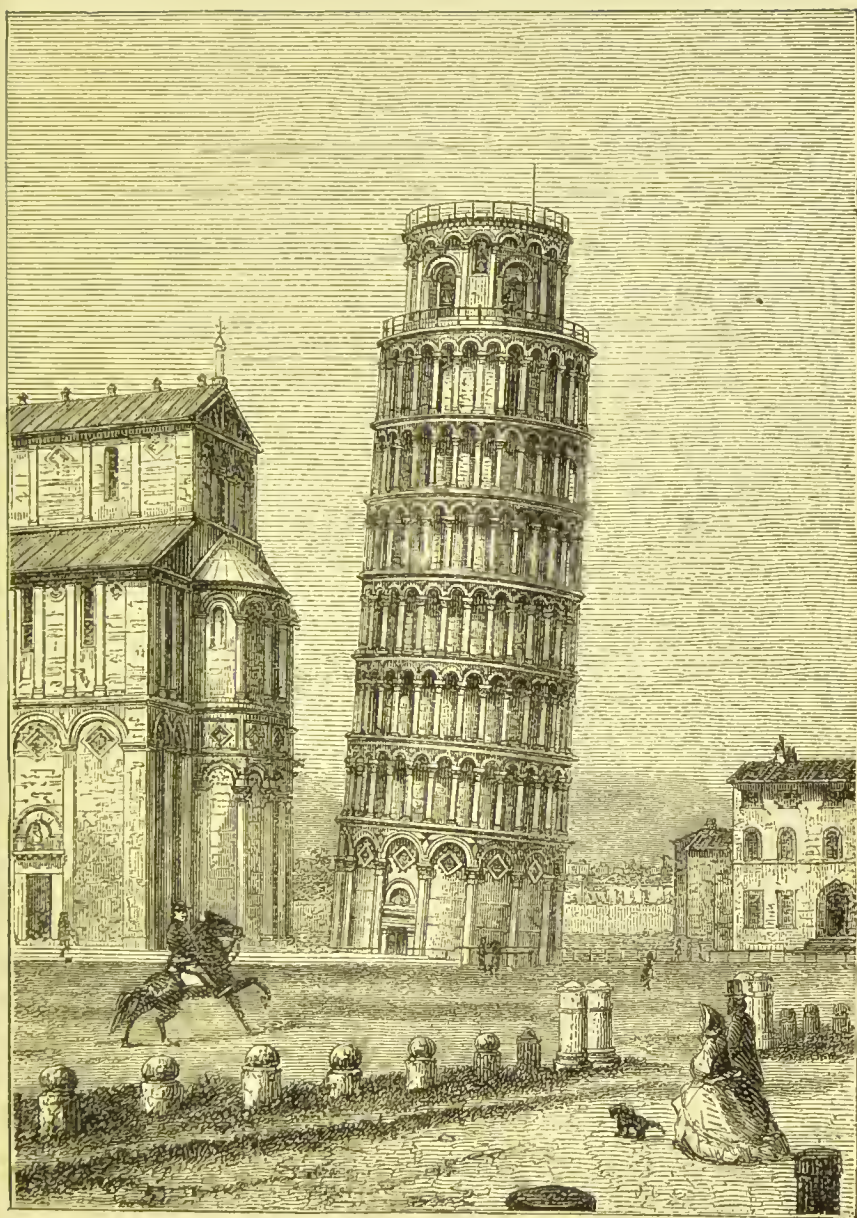


IT was not to be expected that the evidence of Galileo's eyes would be accepted by his opponents, and he therefore undertook to prove the truth of his assertion by the testimony of their own senses. In the presence of a considerable gathering of learned Pisans he ascended the celebrated Leaning Tower, and from the side of the summit which overhangs the base he caused several different weights to be dropped at the same moment. Of course they all struck the pavement below, if not with one indistinguishable impact, at least so closely together that the interval of time could not be measured. This simple experiment, so easily capable of repetition by any two men who would take the trouble, one to ascend the tower for the purpose of dropping the weights, and the other to watch them on the pavement below, might have

been thought proof demonstrative. And so it was. But what it was thought to prove was, not any mistake of Aristotle, but the depravity of Galileo.

In fact his arrogance was not to be borne. The whole world of learning had for nearly two thousand years unanimously regarded it as an established conclusion, beyond the reach of any possible dispute, that a big stone would fall faster than a little stone, just in proportion to its difference in weight. And now here comes this young professor, not yet thirty years old, and has the audacity to declare that the whole world of learning is wrong! Nay, more; he performs an experiment to prove it; and, worst of all, his experiment justifies his assertion! Such conduct is unpardonable. It strikes a blow at the foundations of the whole recognised system of knowledge. If Aristotle was not right in a simple matter like this, how could it be believed that he was right in anything? Existing libraries might as well be burned at once. Men must be content to acknowledge hopeless ignorance, and with acknowledged ignorance would come the return of barbarism. So conclusive was such reasoning thought to be in the sixteenth century, that the expulsion of Galileo from Pisa was felt by the protectors of knowledge there to be their only security against a destructive revolution.

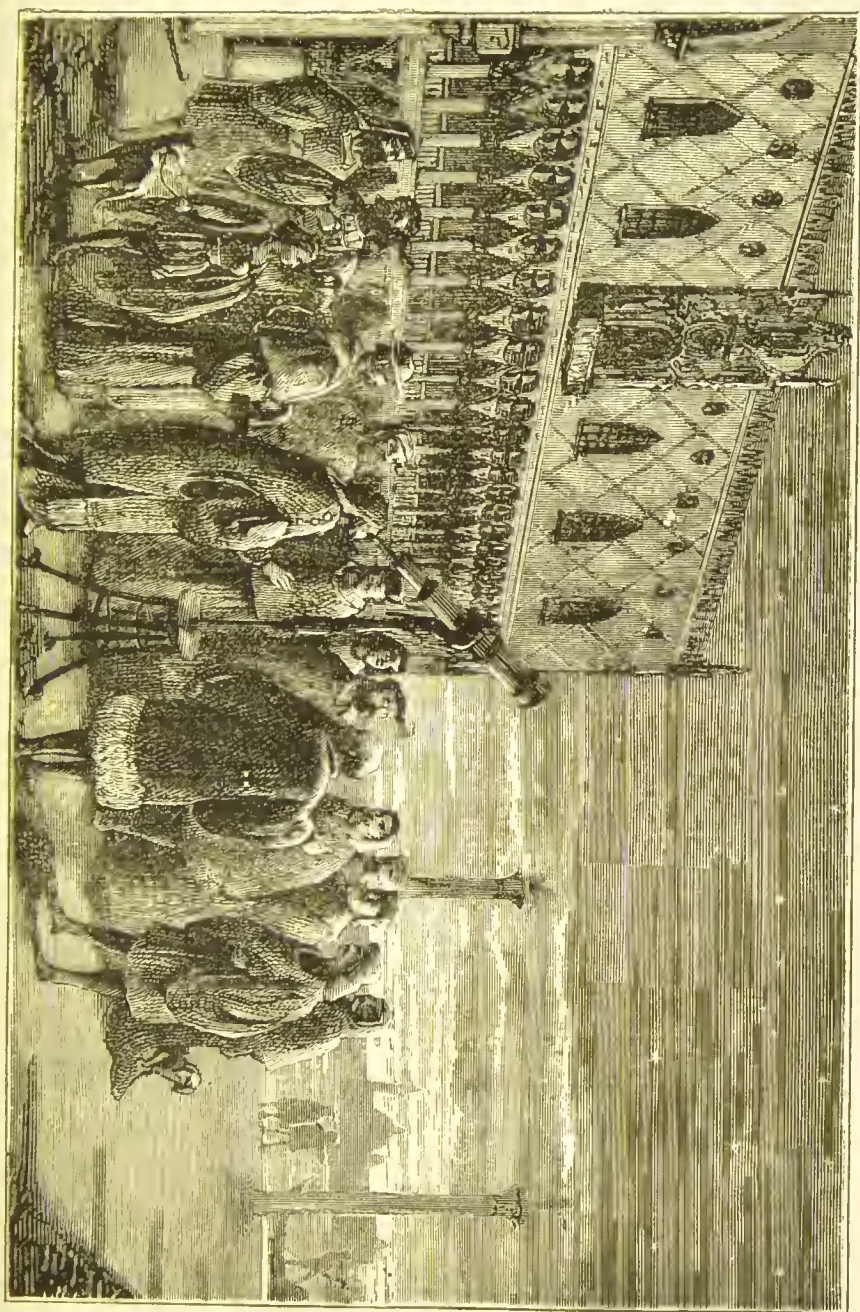




The Leaning Tower at Pisa.

We need not trouble ourselves with the petty persecutions by which the desired end was brought about. It is enough to know that in 1592 he was very glad to accept an opportune appointment to a professorship at Padua, which city was then under the dominion and protection of the Venetian republic. There was a special advantage in this protection at that time ; for Venice had expelled the Jesuits from her territory, and in other ways showed an impatience of ecclesiastical domination such as was unusual, at least south of the Alps. It was at Padua that Galileo constructed his first telescope. He did not invent the instrument himself, or at any rate it was not an original idea of his own. But hearing that an optician in Holland had contrived an arrangement of two lenses which seemed to bring distant objects near, he not only constructed a telescope from this bare hint, but discovered the law according to which the distance of the lenses had to be fixed, a secret which the Dutch optician had failed to penetrate. When this simple and indeed rude instrument was achieved, naturally the first use he made of it was to assist his survey of the heavens. And it is impossible to think without awe of the revelation that rushed upon his soul at the first steady glance.





There is nothing more startling than a sudden expansion of the powers of sense. Any child who has looked through a microscope can understand this. Here is a speck of dust so small that neither shape nor size can be discerned. You put it under the microscope, and instantly, as by a magician's wand, it is transformed into a sculptured shell of exquisite proportions—a tiny ivory palace, whose graceful contour and carved windows are more like the perfection of a dream than a thing of earth. And only to think of the treasures of similar beauty that enrich the dust we grind under our feet or sweep away with contempt, awakens in us a very salutary feeling of the imperfection of our perceptions and of unsearchable riches that lie undiscovered under our very eyes. But surely such a combined rebuke and inspiration was never given to mankind as when Galileo first lifted his telescope to the sky.

Men had been gazing on that nightly vision for millenniums past, until they were familiar with every conspicuous orb. They had called them by names. They had woven them into fancied pictures, framed by lines of fire. They had attributed to them divine influences over life and fortune. The causes of the stately march of most, and the capricious wanderings of a few, had indeed been

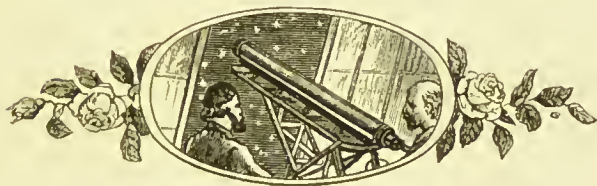
disputed, and were involved in mystery. But to no child is the face of his mother more familiar than the face of the heavens was to the children of men. So constant and changeless was that face, save for passing cloud or storm, that the blue vault was looked upon as the solid roof of man's mortal home, sheltering him from ghastly chaos and eternal night beyond. Whatever secrets were to be found in the deep bosom of the earth or in the abyss of the sea, at least in the empyrean there was an impassable barrier which no eagle glance could pierce, and which set bounds even to the soaring spirit of man. What could astronomers do? They might indeed improve the accuracy of the calculations made by their predecessors as to the recurrence of eclipses and conjunctions. They might decide afresh whether this or that dim star should be reckoned in one constellation or another. They might note more curiously the changes of spots on the sun, or the slowly growing and waning shadows on the kindly face of the moon. But every star they could see had been seen for thousands of years, and the ancient shepherds of Chaldea had already called them by their names. In no direction was the aggressiveness of human curiosity so grandly rebuked or so peremptorily forbidden as by the all-embracing sky.

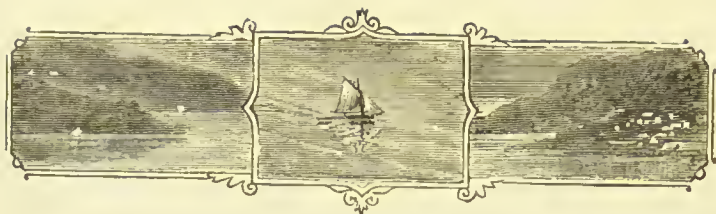


But when Galileo raised his glass those adamantine barriers dissolved into space, and in an ecstasy of emancipation he ranged forth "beyond the flaming bulwarks of the world." Star beyond star came into view, which, though shining for ever in those open depths of space, had never been seen by human eyes before. The realm of chaos was found to be a dream of ignorance, and the boundless expanse of divine order overwhelmed the gazer's soul with awe. The most familiar and most changeless object of human contemplation, under the spell of a simple glass with two lenses, suddenly became the field of the most prodigious physical revelation the world had ever seen since first created eyes were brightened by reason. Indeed, it is difficult for us, who are now so familiarised with the results of science, to do justice to the magnificence of the discovery. If Columbus doubled the habitable earth, Galileo expanded the universe to infinity.

Yet when we remember the modest powers of his instrument we shall not feel surprise that his attention was most attracted by the strange alterations produced in the aspect of the planets. The moon showed herself like a wild world of frowning mountains and dismal valleys, which at first the astronomer thought to be on a vaster scale than

those of the earth. Venus waxed and waned like a little moon, presenting now a full orb'd radiance, and again a tiny crescent like a Cupid's bow. Four little stars were observed in constant attendance on the mighty Jupiter, showing that he was endowed with four moons. From night to night the heavens were always telling something new. And one of the earliest newspapers was Galileo's "Nuntius Sidereus," or "Messenger from the Stars," which from time to time informed his Venetian patrons and the public in general of the latest news from the realms of space.





### CHAPTER III.

#### SCIENCE AND SUPERSTITION.

**H**E was now a man of renown, and was able to bestow coveted favours on the great by calling newly-discovered stars after their names, a dishonour to the orbs of heaven which happily they did not long endure. No one now recognises the satellites of Jupiter as “the Medicean Stars,” though that was the name first given them by the courtly science of the time. But so immortal was such a distinction then thought, that kings, or at least their courtiers for them, looked with envy on the splendid decoration thus conferred on the Tuscan family ; and one zealous hanger-on at the French court indited a long epistle, which, after fulsome compliments, pressingly requested that if Galileo should discover “any other fine star,” he would consent to call it by the name of “the great star of France ;” and if he will be so kind as to

do so, it is intimated that the Christian name Henri would be preferred to that of Bourbon. "You will thus," it is added, "have the opportunity of an act at once just and becoming, while at the same time you will be making yourself and your family rich and powerful for all coming time." What an incongruous invasion of the solitudes of heaven by the gossip of time-serving courtiers!

But this incident was perhaps more than matched by the impertinence of an astrologer, who insisted on knowing the precise influence exerted by these new stars on the destinies of men, and how they were to be reckoned in casting a horoscope.\* That indeed was the only use of the stars according to his superstition; and his method of enforcing his demand was a very curious illustration of the tendency of all superstition to weaken men's understanding of the difference between fact and fiction. We have already seen how the university magnates at Pisa refused to believe their own eyes when stones declined to fall to the ground in accordance with Aristotelian laws. But this astrologer had even greater facility for dealing with facts. He would either acknowledge them or reject

\* The position of the stars at a child's birth was supposed to influence his whole life. A paper describing the heavens at the time and the fortunes thus prophesied was called a "horoscope."

them, not according to the evidence to be adduced for them, but according to the use that might be made of them. For he informed Galileo that unless his request was complied with for instruction in the influence of these stars, "he would reject them altogether and deny them, as being useless and superfluous."

We give these incidents because they illustrate the temper of the time in regard to questions of fact. Men were so preoccupied with slavish submission to authority or theory that they could see no other issue than the question whether alleged facts were laudable and proper according to their own approved philosophy. The real and only important issue, whether they were actually facts or not, did not touch the springs of belief and action. It seems strange to us that men with the use of their eyes and common sense could look calmly on while the stones fell from the Pisan tower in direct defiance of Aristotle, and should thereupon charge the rebellion of those stones to the intellectual pride of Galileo, and should shake their heads at his obduracy. But they did so. The thing is possible to human nature, and there is quite enough of such a temper in our own times to make us study with more than idle curiosity the records of Galileo's day. The worst exhibition of



the spirit was in the pretended service of religion, and it is to that we now turn.

In an evil hour for his own peace, and, indeed, for his reputation as well, Galileo accepted a flattering invitation to leave Padua for Florence, where a position of comfort and honour was promised him under the patronage of the Grand Duke Cosmo de Medici. This was in the year 1610, and a considerable time passed before any serious evil resulted from the step. But the influence of the Papal Court was far more direct and its bigoted rule far more unmitigated at the Tuscan capital than in the Venetian republic. It ought therefore to have required but little knowledge of the world, or at all events of the Church, to have warned him from such dangerous ground. But it does not appear that he was at all fully aware of the fatal issue that he was raising when he dared to proclaim new truths within the fold of a professedly infallible Church. It seems probable that his theological beliefs or doubts sat very easily upon himself, and that he would have found it difficult to understand the feelings either of a martyr or a bigot. It is only by such indifference to the heights and depths of religious zeal that we can explain the carelessness with which he ran into dangers that might have appalled the bravest heart,

and the abject humiliation by which he sought to escape. One thing only excited him to eagerness—the ambition of adding to the stores of human knowledge; and he was especially fired by the secrets of the stars; but that ecclesiastical jealousy should be touched by the assertion that the heavens moved in one way rather than in another, or that any one should feel it a duty to defy such ecclesiastical jealousy at the cost of torture and death, such were notions that did not naturally enter into his mind.

Accordingly he went to Florence. But he had not been there many months before uneasiness was excited in Rome by the increasing fame of his discoveries. This uneasiness was at first repressed by some lovers of science among the Jesuits, who declared that there was no cause for fear. And Galileo thought that having gone to Rome and given explanations, regarded as satisfactory, he had made assurance doubly sure. But like every man who makes strong and definite assertions, Galileo multiplied enemies as well as friends. The former stirred up a zealous Dominican friar, who made the astronomer and his discoveries the object of solemn denunciation. It was not in accordance with the Scriptures, he said, to talk of the earth going round the sun. For the Bible always speaks

of the sun and moon as movable, while the earth is fixed. To illustrate this point he referred to the passage in the book of Joshua, where the captain of the Lord's host is described as saying, "Sun, stand thou still upon Gideon, and thou moon in the valley of Ajalon;" and it is added: "So the sun stood still in the midst of heaven, and hasted not to go down about a whole day." Galileo replied that the doctors of the Church had not interpreted the Bible properly, and especially that this passage had not been fairly understood.

It is easy to conceive what indignation this unfortunate reply excited. Was he, an uninstructed layman, to teach the authorised professors of theology? It did not occur to them that it might be at least equally unreasonable for those who had never looked through a telescope to tell a man who had done so what he ought to have seen or not to have seen. And this was just what they were undertaking to do. Perhaps the supposed but most unreal antagonism between science and religion has often been embittered by the incongruous position of some defenders of the faith. The true line for the apostles of religion is to insist on the imperishable facts of consciousness, which can no more be shaken than the foundations of the world. "As the hart panteth after the water-

brooks, so panteth my soul after thee, O God. My soul thirsteth for God, for the living God : when shall I come and appear before God ? ” There is no answer that can still such a cry, but the revelation of the Eternal in the soul. But when, under the pretence of official or corporate infallibility, misguided guardians of the faith attempt to teach skilled observers of nature what they are to see or not to see, they only ignore the omnipotence of facts, and demoralise men’s sense of the difference between truth and falsehood.

But such reflections were impossible to the Papal Court in the seventeenth century. In 1616 the Congregation of the Index\* suspended the publication of the book of Copernicus on the system of the heavens “until it should be corrected.” Perhaps no more amazing illustration of the stolid arrogance of ignorance can be found in all the records of superstition than this. The views of Copernicus were founded on careful observation, and constructed by a course of irrefutable reasoning ; and now a number of men, most of them knowing nothing whatever of the facts or their significance, presumed to order that this miracle of the human intellect should be taken back, like a careless

\* This is a Board empowered to issue an “Index” of all books that a good Catholic ought not to read, and so far as possible to suppress them.

schoolboy's exercise, and so altered as to set facts at defiance, in order to save the vested interests of ecclesiastical pedagogues.

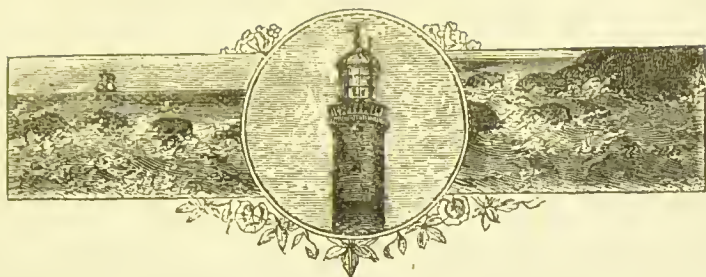
Galileo was much moved by this insolent bigotry. He had not himself yet written nor openly said anything which could bring him into the clutches of the Inquisition. But it was too plain that his telescopic observations tended to confirm Copernicus; it was generally and rightly believed that he had adopted the new astronomy; and after the invectives of the Dominican friar he had felt it necessary to make a visit to Rome for the purpose of securing himself. During this visit it was rumoured that he had been compelled to abjure his opinions and had been subjected to ecclesiastical censures. And, therefore, to save his reputation for orthodoxy even at the expense of his character for straightforwardness and his claim to free inquiry, he obtained a certificate under the hand of Cardinal Bellarmine, to the effect that he had not been subjected to any censure. But the certificate went on to add,—what should never be forgotten in connection with Papal claims to infallibility,—that a declaration of the Pope, solemnly published by the Holy Congregation of the Index, had been communicated to Galileo to the following effect: “The doctrine attributed to Copernicus on the



alleged movement of the earth round the sun, and on the place the sun would thus occupy at the centre of the world, &c., is opposed to Holy Scripture, and consequently need not be either attacked or defended.”\* The warning thus conveyed was afterwards used with cruel effect against the man who had solicited so humiliating a certificate.

\* Quoted from Louis Figuier's "Vies des Savants Illustres."





## CHAPTER IV.

### THE INQUISITION.



THIS is needless and indeed impossible to follow the tedious intrigues of the next ten years, during which the powerful influence of the grand-ducal court barely sufficed for the protection of the astronomer. Cosmo,\* his patron, was now dead, and the minority of his successor threw the power for some time into feminine hands. Galileo's security was thereby lessened, but having, as we have said, nothing of the martyr spirit in him, he had no scruple either as to the use of back-stairs influence, or as to the most effusive professions of submission to the teaching of the Church.

When in 1623 Cardinal Maffeo Barberini became Pope under the title of Urban VIII., the astronomer, now in his sixtieth year, fondly imagined that he was secure of protection for the

\* Duke of Florence.

brief remainder of his days. For the new successor of St. Peter was a man much given to dabbling in science, and had in earlier years been ambitious of Galileo's society. He must have known very well the opinions of the latter on the Copernican theory ; for he had met him in familiar converse. He corresponded with him ; and at least one expression amidst many flattering compliments appears clearly to intimate an agreement in Galileo's opinions. At any rate those opinions had not lessened the cardinal's esteem for his friend ; for he had composed verses in his honour, " which, however unworthy of the greatness of the astronomer, might be accepted," he hoped, " as a proof of sympathy and affection." There is little wonder therefore that Galileo's expectations of more freedom should be encouraged by the elevation of his friend to the Papal chair. And these anticipations were confirmed at first by a letter of the new Pope to the Grand Duke, in which the former expressed admiration, not only for the deep knowledge but also for the sincere piety of the astronomer.

But Galileo was doomed to disappointment. In the first place the new Pope was necessarily bound by the infallible decree of a predecessor ; and no flattering attentions on the part of his

former friend could relax the iron bondage under which the priestly prince himself was bound. In the next place the very friendship on which Galileo relied proved to be a treacherous mine beneath his feet, and exploded upon him with a horror of fire and darkness that covered his last days with physical misery and moral ignominy. Indeed it gives the last touch to the infamy which blackens the records of ecclesiastical infallibility in that age, when we learn that the condemnation launched against astronomical truth was not the issue of mistaken zeal for religion, but simply the malignant revenge of petty personal spite.

The offence which brought Galileo to the bar of the Inquisition was ostensibly the publication of his book entitled "Dialogues concerning the Two Great World-Systems." Its intention was to compare the Ptolemaic and Copernican systems, and to show the superiority of the latter. In the Dialogues there are three speakers, two of whom, Sagredo and Salviati, represent the views of Ptolemy and Copernicus respectively, while the third, Simplicio, an old-fashioned soul, incapable of comprehending that the world has anything new to reveal, refers every question to the authority of Aristotle, and causes much

amusement in his ancient childhood by a prattling, querulous pedantry. This book had cost much labour; and hoping to secure protection for it from a friendly Pope, the author took it with him to Rome in 1630.

Here he sought the president of the Sacred Palace—lord chamberlain perhaps we should call him—and introduced his Dialogues to his notice. He described them as a collection of scientific trifles, rather entertaining than serious, and requested that the chamberlain would criticize them severely and expunge freely anything that might appear to him objectionable. The official read the book, or at any rate professed to have done so, and returned it with a permission under his sign manual to print it. Unfortunately this permission was available only for Rome, and Galileo much preferred Florence as the place of publication, and sought a new licence, promising to submit the book afresh to any ecclesiastical censor who might be named in the latter town. The chamberlain agreed, but requested to have the former certificate returned to him for alteration. He obtained it on that understanding, but treacherously kept it, and refused every appeal for its recovery. However, the work was licensed by the Florentine censor named to the author, and was published in 1632.



Now came the outburst of the storm. Somehow or other the Pope got it into his head that the simpleton in the Dialogues was intended as a portrait of himself. There seems to have been no ground whatever for the supposition, other than the fact that some arguments of Simplicio had been occasionally urged by Cardinal Barberini. But then they were the common property of the Aristotelians of the day. Galileo disavowed the imputation, doubtless with complete sincerity, and also with the energy of terror. The Grand Duke used his good offices ; but all in vain. And under the threat of excommunication, then so terrible, the poor old astronomer was compelled to appear before the Roman Inquisition. In forming our opinion on the real grounds of this severity, it is impossible to forget that the obnoxious book had been twice licensed by ecclesiastical authority, after the most ample opportunity of mastering its contents. It is therefore difficult to resist the impression that something other than the doctrine contained was the real cause of this sudden rigour. The wounded pride of the Pope was too clearly the impulse which led the infallible Church to record its irreversible judgment against the truth declared by the heavens as to the glory and the handiwork of God.



## CHAPTER V.

### A CLOUDED SUNSET.



T was in 1633, the seventieth year of his age, that Galileo, weakened by rheumatism and palsied by terror, appeared before the "holy office." He was treated with exceptional indulgence, owing to the strenuous efforts of the Tuscan embassy. He was allowed to reside with his friends until the time of his examination ; and then his removal for a short time to the prison of the Inquisition was probably intended more to frighten him than for any other purpose. It has been a point of much dispute whether he was actually put to the torture ; though it is impossible to doubt that the fear of it added to the horror of his position. All probabilities seem to be in favour of the negative conclusion.

But the authorities of the Roman Church have only themselves to blame for any uncertainty

which yet rests upon the question. For they have persistently refused to publish the documents in the archives of the Vatican, the evidence of which would be conclusive. The documents, bound up in a volume, were carried to Paris by Napoleon I. amongst many other Italian spoils, and a translation was commenced which was interrupted apparently by his fall. There the matter rested till 1845, when the volume was restored to the Vatican, under promise, 'it is said, of publication. Some portions have been made public, but not the whole. And it is just this concealment which gives plausibility to the surmise—for it is nothing more—that torture was really inflicted. On the other hand, if this had been the case, it must have been known to Galileo's friends on his early release from the prison of the Inquisition. He had a sufficient number of enthusiastic admirers, beyond the reach of the Roman court, to have trumpeted such an infamy to the whole world. But such evidence is wanting.

Besides, the court of Florence had great interest at Rome, and an ambassador who secured to the illustrious prisoner exceptional indulgence in secondary points of treatment, would certainly bring the whole weight of his influence to bear to secure him from the worst practices of priestly cruelty. And

in addition it may be remarked, that men usually refrain from atrocities if they can get their own way without them. But Galileo never seems to have disputed the pretensions of the priests for a moment. His pleas were only two : first that he had never offended, and next that if he had, he was quite ready to say whatever they wished. It is improbable then, that under such circumstances, and in the face of a powerful court, they would put him to the torture. Whatever credit the advocates of earthly infallibility think they can gain for their cause from such admissions must be conceded to them.

Galileo was subjected to four examinations, which we cannot follow in detail. He made no attempt to maintain his right to discover or proclaim the truth. He earnestly protested that he had never intended to contravene the authority of the Church. The accusation against him was, in effect, that after being warned so long ago as 1616 of the Papal declaration that the Copernican doctrines were contrary to the Scripture and ought not to be defended, he had nevertheless perversely and wickedly maintained them in his recently published Dialogues. At his first answer he declared that in the condemned book he had neither maintained nor apologized for the doctrines in question ;

but, on the contrary, he had made it clear that the arguments of Copernicus were weak and inconclusive. In this hardy denial of despair he of course alluded to the reasonings of those speakers in the Dialogues who defended the principles of Aristotle and the system of Ptolemy.

It was, however, far too obvious that the victory had been intentionally left with the Copernican advocate. Accordingly, at his second examination, he humbly said that he had reflected upon his former answers, and had re-read his book. He must now admit that in some passages, to a reader who was not well acquainted with him, it would certainly appear that the arguments favourable to the false opinion he had wished to refute were stated with suspicious force. But his fault, he pleaded, had been nothing more than ignorance and inadvertence. He perceived, however, that he had not said enough to satisfy the judges. He therefore offered, at another hearing, to continue the Dialogues in such a manner as to undo any mischief that had been done. "I undertake," he said, "to add to them one or two discussions, in which I will return to the arguments set forth in favour of the false and condemned opinion, and I will give them the most complete refutation with which it shall please God to inspire me."



Alas, alas ! Was this the lesson Galileo had learned from the imperturbable, irrefutable stars ? It is not indeed for mortal weakness to fling at his memory any stones of reproach. But we should be wanting in reverence for higher heroism and in gratitude to our Maker, if we did not give thanks for the noble contrasts afforded in the story of the good fight of faith. Granted that Galileo was old ; yet Polycarp was some sixteen years older when, amidst a raging amphitheatre, he chose death by torment of fire rather than the denial of his Lord. Granted that he was suffering from bodily pain ; yet the martyred women of Lyons, whose story is preserved by Eusebius, endured days of torture, uncomplaining, and strong in spirit. Granted that he was constitutionally weak ; but we cannot help remembering the girl Margaret Wilson bound to the stake amidst the flowing tide on Solway Sands. The water rises round her straining neck ; it bubbles about her panting lips ; it chokes her struggling breath. She is gone ! No ! the pitiless murderers unbind her, restore her consciousness, cherish her into life again, only to try her faith once more. “ Will you forswear the Covenant ? ” they ask. “ Never ! ” she cried. “ I am Christ’s ! let me go ! ” And once more the torment of the waves is faced, this time to be the gate of heaven.



With such examples before us it is a dishonour

to human nature if we allow great names clouded with inconsistency to lower our standard of heroism. However painful the truth, it must be frankly owned that in the case of the great Galileo the ambition of knowledge entirely failed to give the strength and truth of character which weak women and children have received from faith. There is indeed a devotion to the pursuit of facts which is in itself of the nature of a religion, a love of truth for its own sake; and this has its willing martyrs as well as Christianity. But the mere curiosity of knowledge feels no sacredness in truth; and it is impossible to give Galileo the credit of rising into that higher region of intellectual aspiration in which fact is seen as the garment of God. Hear him in the miserable abjuration, the public utterance of which was a part of his sentence: "I, Galileo Galilei . . . swear on the Holy Gospels, which I touch with my hand, that I have always believed, that I do now believe, and that with the help of God, I will always believe, that which the Holy Catholic Church, Apostolical and Roman, maintains, recognises, and teaches. But considering that after being commanded by the Holy Office to abandon entirely the false opinion . . . that the sun is the centre of the world and immovable, while the earth is not the centre, and moves,

I have written a book in which this false opinion is maintained by strong arguments, to which I have not always given the answer; therefore with a sincere heart, and in entire loyalty, without any suppressed evasions, I forswear, I curse, I detest, the above-named errors and heresies, and solemnly engage to submit to the censures of the Church.”\*

Surely this was humiliation enough; but common tradition will have it that he descended to yet a deeper depth by uttering between his teeth after the recantation, “*E pur si muove*”—“It moves, for all that.” This tradition, however, rests on no contemporary evidence; it is an imaginary addition of after times; and we are glad that it is so. The endeavour to save consistency and recover self-respect by a subterfuge of this kind would only have been an additional evidence of moral weakness.

The poor old man lingered on, lame and half blind, for several years, during a great part of which he was confined a prisoner in his own villa near Florence; and only on the near approach of death was he solaced by free intercourse with friends. Intellectually he is a grand figure in the history of human discovery; and the establishment

\* The phraseology is compressed, mainly by omission, but what is given is substantially word for word.

of the truths he was forced to abjure has been a rebuke under which the impious pretence of human infallibility should have withered. But after all, it is not intellectual achievement which neutralises superstition so much as moral emancipation; and this is the gift, not of mental greatness, but of goodness.

The sacredness of truth, as distinguished from its interest, does not impress itself on the intellect, but on the conscience. And no knowledge educates the susceptibilities of the conscience, except that which reveals God to the heart. Astronomy scales the stars, and Geology sounds the abyss, and much credit they take to themselves for such achievements. But the eye of Faith has already transcended them both, and in its contemplations of the Infinite is overwhelmed with that sense of nothingness from which all humble obedience springs. If the story of Galileo rebukes infallibility, it also condemns the pretence of science to do the work of religion. Not the excitement of curiosity, but only the solemn inspirations of loyalty to God, give men in the grandest crises the courage of their opinions. And if, intellectually, few born of women have been greater than Galileo, morally it must be admitted that "the least in the kingdom of heaven is greater than he."





"Lame and half blind."



# JOHN KEPLER.

---

## CHAPTER I.

### HIS TITLE TO FAME.



JOHN KEPLER was a conspicuous illustration of the joys and the martyrdom of knowledge. His name and that of Sir Isaac Newton may be coupled as the two stars of greatest brightness in the firmament of astronomical fame. But there has hardly ever lived a man whose earthly lot would be less envied by a worldly mind. Compared with the precision of Kepler's magnificent generalization, the theories of Copernicus were merely happy guesses, or, at best, prophetic dreams. Contrasted with Kepler's deep insight into universal law, the work of Galileo was that of a mere showman amongst the stars. But further than this, there was in him, what is not always associated with brilliant genius, an elevation of moral nature which commands our reve-

rence, and a modest manliness that wins our love. His very faults and inconsistencies invite sympathy by the childlike simplicity with which they were sometimes acknowledged.

His practice of astrology\* gives a shock to modern minds trained to feel the severe truth of astronomy. But his frank defence of his engagement in a work that he despised, at any rate prompts some sympathetic efforts to realise the immense difference in matters of this kind between the sixteenth, or even the seventeenth century and the nineteenth. His life was not long, extending only to fifty-six years; and it was like a melancholy autumn day, across which dreams of summer flash only to sink into the shadows of approaching winter. From the time when he acted as make-shift potboy in his father's little beer-shop that never paid its way, until he died worn out with hopeless dunning at imperial doors for debts that were never discharged, his whole career seemed to onlookers a succession of disappointments, bereavements, and betrayals. And yet such was his exulta-

\* The supposed science of judging future events in this world from the position of the stars. It was the hope of being able to do this that led men to study the stars. Thus astrology was the beginning of astronomy. In the same way men were attracted to the study of the metals and acids by the notion that they could make gold. This pursuit was called alchemy, and it was the beginning of chemistry.



tion in the work of unveiling the secrets of the stars that he declared he would rather have the place of the poor astronomer than that of the Elector of Saxony.

He was born in December, 1571, more than a hundred years after Copernicus. But it would be a mistake to suppose that the Copernican theory had at this time been generally accepted, even by astronomers. The truth is, that Copernicus had done very little towards placing the true theory of the heavens on a sound basis. He maintained indeed that it was a vulgar error to think of the sun as going round the earth, and that the real truth was the reverse of this. But he was not original in this speculation, for it had been suggested long before his day ; and he did nothing to demonstrate it, except to argue that the movements of the planets and the apparent path of the sun were less confusing on this idea than on the old one of concentric spheres. But, in reality, his arguments were hopelessly crippled by the imperfection of his knowledge. He placed the sun in the mathematical centre of the universe ; and he set at a vast distance from this centre the sidereal sphere in which the stars held fixed and unvarying positions. Then between this sidereal sphere and the sun he supposed the planets

including the earth, to move in *circular* orbits, of which the sun was at the exact centre. Now, on such a theory as this the apparent movements of the sun and planets are almost as difficult to explain as on the Ptolemaic system. In fact, there was little to choose between them; and therefore there is no wonder that the ideas of Copernicus made few proselytes. The world was yet waiting for the real secret which should set the divine plan of the heavens, not in the misty and uncertain light of dreams and conjectures, but in the daylight of everlasting fact.

This secret Kepler was born to reveal. But no one who knew his miserable childhood could have supposed it possible. His father was what is called in the Scotch dialect a "ne'er-do-weel." Some previous ancestor at a remote distance had been ennobled; but as rain dissolves the starch from fine linen, so a discouraging drizzle of constant misfortune soaked all thoughts of nobility out of the Keplers, until John found it necessary to look up his claims in order to win a wife. The grandfather had been burgomaster of Weil, in Würtemberg; but John's father went downhill till he found himself struggling to make both ends meet by the profits of a miserable beer-house in the village of Ermendingen. The struggle was in vain.



He went to the Turkish war, and was no more heard of. The mother must have been of a sterner and stronger nature. The superstitious horror of witchcraft probably often selected as its victims women whose superiority to their neighbours gave them, to vulgar eyes, a stamp of singularity. If so, it is noteworthy that Kepler's aunt, with whom he lived a good deal in his childhood, was condemned and burnt as a sorceress, and that his mother was, many years afterwards, in imminent danger of a similar fate.





## CHAPTER II.

### THE YOUNG PROFESSOR.



AT the age of six years Kepler had a severe attack of smallpox, which threatened his life, and permanently weakened his sight. When the beer-house at Ermen-  
dingen was set up he was taken from school to save the wages of a potboy. He does not seem to have been regarded by his own family as an interesting child. At thirteen he had another attack of serious illness, and, it is said, was neglected even by his mother. But his only sister, some years older than himself and married to a Protestant clergyman, had pity on him, and under her care he recovered. He remained in her house; and the opinion of his brother-in-law as to his capacities was shown by sending him, as soon as he had gained a little strength, to work as a ploughboy. But his frame was too weak for this kind of labour; and it was

probably in despair of any other resource, and under the attractions of grand-ducal charity, that he was sent at the age of eighteen or nineteen as a theological student to Tübingen.

He received, of course, some preparatory instruction, but even then he felt himself at a great disadvantage, and for some months could scarcely master his aversion to the severe mental effort required. The first stimulus that roused him seems to have been theological controversy; but the part he took was displeasing to the Protestant ecclesiastical authorities, and all his prospects were blighted. It appeared likely that he would have to quit the university, if not in actual disgrace, at least with the shame and bitterness of failure. But the fame of Michael Moestlin, professor of mathematics and astronomy, attracted him to take a course of lectures in the latter subject, and the result was the opening, not only of a new career to Kepler, but of a new and ever-expanding horizon to astronomical science.

Moestlin was one of the very few who had at that time adopted the Copernican system, and he soon initiated his new pupil into its significance. Kepler adopted it with all the ardour of youth, and showed such appreciation as much endeared him to his instructor. It was probably owing to

the renowned master's recommendation that he obtained at the age of twenty-two years the chair of mathematics at Graetz, in Styria. If the young man could have exercised any choice in the matter, it must be acknowledged that it was a very imprudent thing on his part to accept such an engagement. Styria was a Catholic province, and he was regarded even by the authorities of a Protestant university as dangerously liberal in his opinions. He was an ardent astronomer, eagerly devoted to the young science just then preening its wings for its flight into infinity, and shaking itself from the dust and fluff of the astrological nest in which it had been hatched. But in Styria the only notion of astronomy was that it was a convenient method for informing farmers beforehand whether turnips or barley would be the better crop, and whether any new phase in the Eastern Question would lessen the hands available for labour. However, as a matter of fact the young professor had no choice. He had his bread to earn, and he knew no other way of earning it.

This excuse will generally be regarded as satisfactory so far as his imprudence was concerned ; but to what length are we to extend this excuse ? Should he instantly have resigned his chair when he found that he was expected to produce astrological

predictions in which he did not himself believe? Yes, certainly, we should say, judging by the clear light we have now on the uniformity of nature, and looking from our side of the impassable gulf now separating the definite knowledge of the present from the mixture of tradition, abstract reasoning, and dreamy suggestion that passed for knowledge in dimmer times. But it is difficult for us so to realise the conditions under which Kepler lived as to form a just judgment. It is not certain that at this early age he had wholly emancipated himself from astrology. There was a potent element of mysticism in his nature, which at a later period led him to search for occult spiritual analogies in the divine architecture of the heavens. It may be supposed, therefore, that at twenty-two years of age his mind was not so clearly made up as to the falsehood of astrology, but that he imagined there might be something in it if the right method of interpretation were found. Now, in this confused condition of thought men easily yield to habit and necessity without fully realising their inconsistency with their better selves.

But, unfortunately, there is no doubt that in a few years Kepler did come to realise this inconsistency, and that the discovery made no difference whatever as to his practice. It led him indeed,



according to Bayle, to veil his predictions in ambiguous terms, as though he were trying to satisfy vulgar curiosity and his own conscience at the same time. But this was not the excuse he made to himself. Let us hear his own language as quoted by Louis Figuier. It may not be satisfactory to us, but it is almost startling in its frankness, and the argument was, at least, conclusive to himself:—

“To purchase philosophical freedom by the ruin of one’s family is the part neither of an honest nor of a pious man. For a philosopher to feel unshackled in his devotion to study he must, at least, have food and lodging. He who has nothing is the slave of every one ; and who willingly makes himself a slave ? If I draw up calendars and almanacs it is, oh my God ! assuredly a hard drudgery ; but it is for the present necessary. To free myself for a very short time from this slavery I should have to undergo, later on, a still more shameful servitude. It is only to keep my annual salary, and to maintain my title and office as astronomer, that I deliver these futilities to the ignorant curiosity of my public. For, in fine, it is more honest to draw up almanacs with predictions than to beg my bread.”

Elsewhere he says, with more humour than

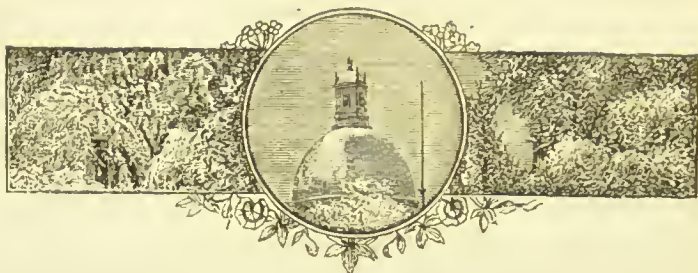
truth—"Astrology is the daughter of astronomy; is it not right that the daughter should feed the mother, who otherwise would run a chance of dying by hunger?"

The relation is more properly the reverse; for astronomy is the daughter of astrology, just as chemistry is the offspring of alchemy. From this point of view his argument might have had more practical force; for he had the opportunity of becoming an astronomer only through the demand of the time for astrologers. Nevertheless, the conclusion drawn by most readers from this feature of his life alone would be that he was a man of little moral susceptibility. That this, however, would be an unjust judgment is made evident by the next passage in his career, which demands our attention. He had married a widow lady with a little property and some pretensions to social dignity, and for a year or two he lived in considerable comfort. But in 1599 the animosity of the Catholics in Styria against Protestant heretics rose to such a height that he found it prudent to retire for a while from Graetz. The storm seemed to blow over, and he was allowed to return on condition that he showed himself careful and reticent. If he had possessed the same pliability of moral constitution as Galileo, the difficulty might easily have been arranged by

his abandonment of the Reformed Faith. But whatever laxity Kepler might allow himself in regard to astrological almanacs, he was quite immovable in his religious convictions.

"I am a Christian," he wrote, "attached to the Augsburg Confession by an earnest examination of the doctrine, not less than by the instruction received from my relatives. This is my faith; I have already suffered for it, and I do not know how to play the hypocrite. Religion is for me a serious matter, which I dare not treat with lightness."

In vain he was plied with threats and promises. "He did not know how to play the hypocrite;" and finally he was compelled to leave Graetz at a few days' notice, after disposing of his wife's property at a ruinous loss, not knowing where to look for the means of living. When we consider the greatness of this sacrifice for conscience' sake, the surrender he made of honour, security, comfort, and, above all, of assured opportunities for the pursuit of his soul's delight, the mystery of the stars, we feel sure that John Kepler had in him, after all, the stuff of which martyrs are made; and the rest of his life sustains the impression. In truth, that life was henceforth but a continuous martyrdom in testimony of the true glory of God in the physical heavens.

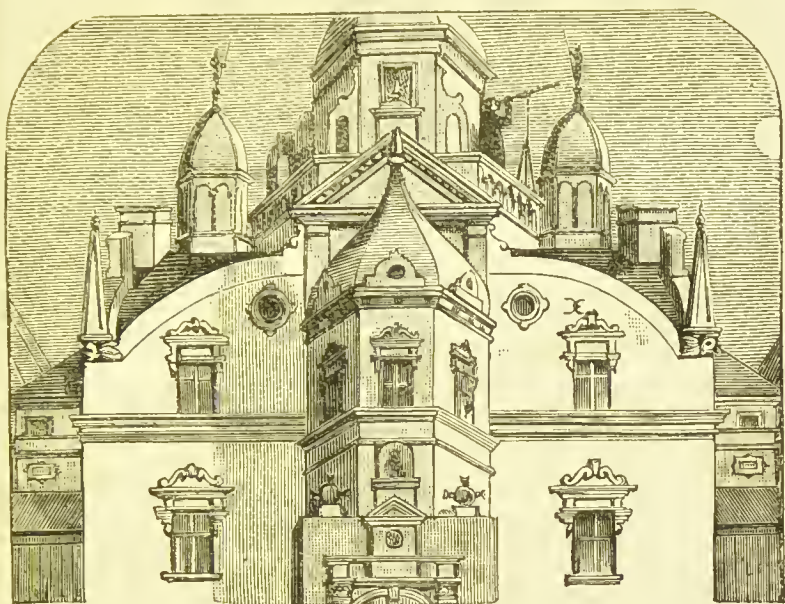


## CHAPTER III.

### ASTRONOMER ROYAL.



DURING Tycho Brahe, the Danish astronomer, who had also been driven by bigotry from his home, and had found a refuge in Prague, heard of Kepler's need. He knew him already through his works as a young astronomer of genius, and now sent him an invitation to become his assistant. The offer was gratefully accepted, with sanguine hopes. But no sooner was the arrangement completed than it gave rise to bitter disappointment. Kepler was not admitted, as he had hoped, to an insight into Tycho's methods. He was kept to the mere drudgery of a subordinate; and instead of a regular salary, money was doled out to him barely sufficient for his absolute needs, and by a few florins at a time. Whether through chagrin or want, Kepler fell into a long and severe sickness,



Tycho Brahe's Observatory.

from which he had not recovered more than five months when Tycho Brahe died, leaving to his assistant, almost by right of succession, his post as astronomer royal, and the still more precious inheritance of his recorded observations.

A salary of £150 a year seemed splendour, and the documents of the old master were a princely fortune. But, alas for the vanity of human wishes! the salary was only paid at rare intervals, and arrears accumulated rapidly. And, to add to the bitterness of poverty, his wife was seized with epileptic fits, which terminated in insanity and



death. The children of this marriage were also frail and diseased, scarcely surviving their mother. The labour, watching, and weariness of the father, who was devoted to his family, may be imagined. But what surpasses the imagination is the fact that during these years of misery Kepler, with his eyes on high and his soul in the heavens, was patiently working out the grand generalizations by which the eternal order of the planets was revealed. A gleam of hope and love came after these sad days. He contracted a second marriage with a true woman, one of the common people, who, however, had received education enough to appreciate her husband's mission. But children came fast and bread was scarce, so the astronomer had to undertake the humblest drudgery of teaching, to supply the place of a salary rarely paid.

Meantime the voices of the stars comforted him in his trouble. The majestic calm of space was deepened for his aspiring soul by the everlasting reign of law that he discovered there. The wandering planets whose aberrations mocked the Ptolemaic spheres, and even drove Copernicus distracted, yielded up their secret to the lonely watcher in a suffering house. He found that spheres and circles were alike dreams, and that the true planetary orbit was the ellipse, one focus

being the centre of the sun. Again, watching the shining globes as they rolled now in unperplexed order, he found variations in their speed, and could not rest until he grasped the law which his faith assured him ruled these changes. And from the realms above, the manifestation of God's order again rewarded undaunted patience. For he saw that, though the speed of the planet varied, the radius vector—*i.e.*, a line drawn from the centre of the sun to the centre of the planet—always covered equal areas in equal times. Once more, as he watched the swift flight of Venus and the stately sweep of Jupiter, his soul hungered for the law that governed the relative speed of these celestial movements. He caught a glimpse of it ; he lost it again ; he saw it once more ; he worked it out, and it was sure. Every planet marched round the sun in times the squares of which are proportional to the cubes of the mean distance from the sun.

These laws are what constitute the brightest fame of Kepler, and raise him far above Copernicus, Galileo, and all astronomers but Newton. As when a light wind blows on a misty land, the hills are bared, and ghosts are turned to trees, and monsters to grazing sheep, and all to simplicity and order, so the utterance of these three laws

blew away the vague cloud that made heaven a chaos. Cycle and epicycle disappeared; excentricities and caprice vanished; and the kingdom of the physical heaven stood revealed. Without such laws Copernicanism must have remained a hopeless puzzle, and Galileo might have gone on fruitlessly for ever discovering new peepshows in the sky; and even Newton must have failed to unfold the mystery of gravitation. But on these three strokes of genius there followed in the world of mind a simplicity and a clearness of vision not unworthy to be compared with the day that dawned when God said, "Let there be light; and there was light." With modest truthfulness to himself and his mission, Kepler appreciated the greatness of his discoveries; and the language in which he finally sent them forth is of a dignity and grandeur fitted for the overture to a new age. The foundations of the new science that he built were deep in the rubbish of superstition and ignorance; but they touched the rock of fact. The materials had been intended by astrologers for far other uses; but Kepler captured them for the truth. Perhaps, also, he was thinking of his own humiliation, and with a flush of pardonable pride he announced the achievement for which he had submitted to it.

"Eight months ago I saw the first gleam of

light ;\* for three months I have seen the dawn ; and now for a few days I have seen the sun in full vision. I surrender myself to my inspiration. I am ready to face mortal men with this confession : that I have plundered the golden vessels of the Egyptians to build of them a tabernacle for my God, far from the bounds of Egypt. If you pardon me, I shall rejoice at it ; if you fling reproach at me, I will endure it. The lot is cast. I have written my book. It will be read ; whether in the present age or by posterity matters little. It can wait for its readers. Has not God waited six thousand years for one to contemplate His works ? ”

A daring and yet humble utterance—teaching us at once the bravery of faith and the modesty of patience. There is in these words the ring of a true spiritual loyalty which is deeper than all creeds. And perhaps the ecstasy of Kepler’s soul at such moments, when, as it were, the smile of God shone out upon him, enables us better than any theological comment to understand the Psalmist’s words : “Thou shalt make them to drink of the river of thy pleasures ! ”

There is no more to tell in a brief notice like this. Those high words had scarcely seen the

\* This refers apparently to the last of his laws only.

light when the horrible news was brought to the writer that his aged mother was arrested as a witch. For five years the tedious process went on, while her son hurried often hither and thither, petitioning, imploring, bringing all influence to bear that he could command. Meantime the brave old dame stood her ground and refused to commit herself. She even turned the tables on her judges, and reproached one of them with the corrupt means by which he had attained his office. Finally she was released, after a vain effort had been made to frighten her with instruments of torture. She only survived two years, and her son remained not long after her.

The superstitious folk of Ling, where he was then living, persecuted out of their city the son of the alleged sorceress, and after futile efforts to obtain redress, he died at Ratisbon, knocking in vain at the door of the imperial treasury, which owed him twenty-nine thousand florins. He left behind him twenty-two crowns, and one coat, two shirts, and a few copies of two of his own works, everything else having been sold for bread. But no millionaire who ever scattered gold round his bed left such a bequest to the human race.

.







# SIR ISAAC NEWTON.

## CHAPTER I.

### SCIENCE IN THE SEVENTEENTH CENTURY.



THE year of Galileo's death saw the birth of Sir Isaac Newton. But though these two great men were so nearly contemporaries, they may be said to have lived in two different worlds. In Galileo's time the new system of the universe announced by Copernicus was still regarded by the rulers of the Church as a dangerous heresy, or at best as an esoteric truth fit only for a favoured few. In Newton's day it had become an established fact, and to doubt it was a proof of vulgar ignorance. Even the disciples of the Italian astronomer could hardly recover the shock given to the inner world of thought by the dislocation

of all their notions about the world outside them. But through the insight of the English philosopher dumb amazement was succeeded by a delighted appreciation of the vaster order of God's true creation. Galileo was suspected, accused, forced to a humiliating recantation. Newton was revered, honoured, rewarded, followed to his grave by the homage not only of his own countrymen but of the world.

The reason of this difference in the position of the two men was, partly the organization of scientific culture in the course of the seventeenth century, and partly the emancipation of English religion from papal domination. Bacon and Descartes on the one hand, Galileo and Kepler on the other, operating on different lines, had made it abundantly evident that physical science required a method of its own, quite distinct from the modes of argument employed by ecclesiastical teachers. It has been said that at this period the philosophy of *things* succeeded to the philosophy of *words*. This is only another way of saying that the authority of facts to a certain extent shook itself free of Church authority. It began to be held that where men could observe the operations of nature for themselves they were bound to believe the testimony of their own experience and reason



rather than the dreams of the fathers. Thus a new class of men arose in the world, with aims and methods that separated them both from the Church on the one hand, and from ordinary secular society on the other. For the most part they were hostile to neither, though their views of the real province of the Church were somewhat vague. But being suspected on both sides such men were driven together, and formed societies for mutual support and for the communication of new discoveries. The most powerful of these were the French Academy of Sciences and the Royal Society of London. There were several others in different parts of Europe, and the result was an organization of the forces of science such as to secure both enlarged influence and increased confidence. Whereas Galileo could only communicate with timid and wavering friends, Newton's observations were eagerly welcomed and respectfully discussed by unions of distinguished men in all the great centres of European thought.

But there can be no doubt that the difference in the relation of the two men to the religious thought and feeling around them was a most important element in their respective positions. In Italy, then as now, the Papacy protested against any suggestion of a possible reconciliation with

modern ideas. Of course facts made their way in spite of all ecclesiastical curses. But every new discovery was regarded as an offence to the Church, and its author was necessarily treated as an enemy to religion. Now without going so far as to say that the progress of science in England has presented no analogy to such antagonism—which, of course, would not be true—it is a mere matter of history that the comparative freedom of religious discussion in this country prevented the unchallenged identification of Christianity with any worn-out theory of the universe. It is indeed undeniable that the opinions then held in England about the nature of the infallibility to be recognised in the Bible have been considerably modified in our own day. But however untenable those opinions might be, they were at any rate favourable to an entire repudiation of any infallibility outside the Scriptures. Farther, no interpretation of the Bible was regarded as unalterable. And though the Tudors and the Stuarts did their utmost to bind their own interpretation of the Bible as a yoke upon the necks of their subjects, it was always shaken off, and the battle of different interpretations was renewed.

Thus the religion of England had its eyes on the future rather than on the past. It was always



looking forward to some interpretation of Scripture that should bring all men to one mind, and it was therefore prepared for any new understanding of the Bible, such as would show the harmony between religious and scientific revelation. Sir Isaac Newton not only sympathised with this attitude of mind, he was himself a conspicuous illustration of it. Although he declined taking orders in the Anglican Church, partly perhaps from scruples as to the form in which the doctrine of the Trinity is set forth in its formularies, yet it is certain that he was an earnest churchman and a devout Christian. He firmly believed that all new discoveries tended only to glorify the God of his fathers and to reveal in clearer light His eternal power. To him the fear that the dissipation of superstition would destroy religion seemed as foolish as the idea that the dispersion of the clouds which make sunrise fantastic would be the ending of the day. Like Stephen and St. Paul he could even rejoice in the thought that what decayed and waxed old was ready to vanish away ; because he was sure that it obscured the true building of God. Yet he never affected to be a religious reformer ; it was not his work. It was sufficient for him to unfold the vision of creation that would give a higher inspiration to the worship of the future.

Thus in the case of Sir Isaac Newton religion and science were not in antagonism; they were firm allies. And this happy harmony was in a great measure due to the fact that he lived in a country where faith had its eye on the future rather than on the past.

It seemed desirable to say this much as to the difference between the relations of Galileo and Newton to their respective surroundings; for the deep peace in which our English astronomer's discoveries were matured and announced had much to do with the intellectual majesty in which his memory is clothed. With the exception of occasional epistolary controversies, his life was passed in serene meditation unruffled by conflict. His magnificent generalisation of the law of gravity dawned upon him as he lay under an apple-tree in rural seclusion, and was matured in the solitude of his study. His mathematical discoveries were conceived and applied in early manhood, when the first consciousness of extraordinary power was dawning upon him, in the midst of approving teachers and admiring friends. Light yielded up to him almost at the same time the secret of its woven complexity. And all the rest of his life was spent in slowly ripening the surprising inspirations of his youth.

He was sent to Parliament as a representative of his University, but he never opened his lips in its debates. After his fiftieth year he accepted, rather to the surprise of his admirers, the lucrative office of Warden of the Mint; and here for a passing hour he felt the tooth of slander. But the lie recoiled upon the slanderer so speedily and ruinously that, except through pity for his accuser, the experience can hardly have disturbed his life-long peace. Newton was not only before his time in his philosophy, he was above it in the self-contained completeness and quietness of a life that knew no ambition or desire beyond the spontaneous fulfilment of a mission as natural to him as effulgence to the sun. The time will come, perhaps, when calm will settle down on all men, because they will realise in themselves the will of God concerning them, and have no wish beyond. But when that happens the kingdom of God will stand revealed. And it is because the freedom, the calm, the unconscious devotion, the completeness of achievement characteristic of Newton suggest what a man is in the kingdom of God, that his life is so well worth our study. His mathematics may be beyond our understanding; but his grand humanity is a type on a large scale of what smaller humanity may be within its own range.



## CHAPTER II.

### A MOTHER'S HOPES.



IN the biography of Newton nearly everything that is most interesting to readers other than mathematical is concentrated within the first twenty-five years of his life. It was before this age that all his greatest discoveries were made, and the remaining sixty years were mainly spent in maturing them. He was, indeed, slow and cautious to an unusual degree in publishing anything to the world. His writings were for the most part the work of his middle life and mature age; but all the grand ideas associated with his name dawned upon him in the earliest years of manhood. There is something dazzling in the brilliancy of those years—a brilliancy not of academic successes, but of conquests in the realm of knowledge. At an age when the clever young men of our time take senior wranglerships or

fellowships, and have their names and lineage advertised to an admiring world, Newton had invented a new mode of calculation that gave fresh powers to astronomy; he had seen the true theory of gravitation; he had discovered the complex character of light, and conclusively proved the true cause of the spectrum. But no one trumpeted his name abroad. He was unwilling even to publish his discoveries. The contrast is suggestive, and might be taken to heart in this noisy age. Those in whom the image of God is most striking imitate God's ways of working, and these are for the most part quiet.

Woolsthorpe, where Newton's father held a substantial yeoman's estate from a tolerably long line of ancestors, was and is still a quiet Lincolnshire village a few miles from Grantham. The house in which the astronomer was born is yet standing, and a sun-dial, constructed by his own hands in early youth, is still, we believe, to be seen upon the wall. It was Christmas Day, in 1642, when he first saw the light. But though he came into the world on a day of happy omen, he was born beneath the very shadow of death; for his father had died during the first months of marriage, and his mother was thus a widow when her first child was born. No wonder that a child born under such



circumstances was weak and sickly. But in spite of appearances he must have had a sound constitution, for he was rarely if ever laid aside from work by illness until a short time before his death, at the age of nearly eighty-five.

When he was three years old his mother married again, and he was for some time under the care of his grandmother, who resided with him on his paternal estate. But his step-father did not live long, and his mother, with a small family, came back to the home of her first married life. After the usual course of village instruction in reading, writing, and arithmetic, he was sent to the grammar school in Grantham. The master there had a good reputation; and Newton's mother was anxious that her son should be fully educated up to the position of a gentleman farmer. She had mapped out his life for him in a manner so apparently harmonizing with the designs of Providence, that it would have seemed almost sinful to doubt the accomplishment of her aims. He should learn the little Latin and less Greek that would serve to enrich his conversation with an air of learning; he should know enough of mathematics to measure land, sufficient arithmetic to keep accounts; then, when he had acquired all this, he should come home and relieve her of all

her anxieties and labours. He would take his place as master of the house. From early morning to late at night he would be diligent in business, looking after the servants and the cattle and the crops, making shrewd bargains at the market. He would be a father to the younger children. At a reasonable age—not too early—he would marry, and his mother, finding a home not far away, would be cheered in her declining days by the love and reverence of grandchildren, and by the prospects of a family future that should be worthy of the past, and yet more prosperous. So parents build their hopes on a future that they cannot control, and too often unfit themselves to understand or appreciate the will of God concerning their children.

At Grantham, Newton lodged with an apothecary named Clarke, who had married a widow with several children. One of these, a little girl some years younger than himself, was, perhaps, the earliest admirer of the youthful genius; for at school he was careless and apparently indolent. His lessons did not interest him, and he “scamped” them. But at his lodging there was always some wonderful piece of work in progress, which his child-playfellow watched with rapture. Sometimes it was a kite, to which a lantern could be attached

to astonish the neighbourhood at night ; sometimes it was a water-clock ; sometimes a mill turned by a captive mouse. The thought required for the invention, and the effort necessary for the execution of such things, of course distracted the boy's attention from school tasks. But the reputation of a dunce there was amply atoned for by the wonder and worship he found when school was over, and when little Miss Storey screamed with delight as the mill was started, or the clock set going, or the illuminated kite sent up aloft. This playfellow afterwards became Mrs. Vincent, and lived to an advanced age ; but to her dying day she always believed she was the only woman the illustrious astronomer had ever loved. Perhaps she was right ; but no one knows ; all that is certain is that he always showed her kindness, and late in life relieved her poverty.

It is an old story how the boy Newton was roused to intellectual activity at school by a blow or a kick in the stomach. One version is that as his assailant was too big to be thrashed by him, he resolved to take his revenge by rising above him in the class. Another version, which, however, bears the stamp of development, relates that he thrashed his opponent first and took him down in class afterwards. But from this time he rapidly improved in his master's good graces, and soon reached

the head of the school. His mother, no doubt, was pleased with the excellent report she received of him, but more from the assurance thus given that he was in general a good boy than from any anticipation of his real destiny. In his sixteenth year he was taken away from school, and introduced to the mysteries of farming and marketing under the guidance of a trusted servant.

This was just the year after Oliver Cromwell's death; and we are reminded of the singular contrast between this quiet family life at Woolsthorpe and the hurly-burly by which the country generally was distracted during those eventful sixteen years. When we read of such times we imagine a fever of anxiety, of anger, or dread, inflaming every mind and invading all the solitudes of life. We can hardly think of farmers jogging to market, occupied mainly with the price of cattle or grain. We can hardly conceive of sleepy villages winking in the sun, and only wakened up to slow interest once in a few months by some driver of pack-horses with his news of a battle fought a fortnight before. But unless at exceptional moments, and with exceptional people, private interests are always, fortunately or unfortunately, stronger than public in their persistent hold on the attention. Children must be fed whether Crown or Parliament be

victorious; and the conflict between life and death in a beloved child that is sick, makes a mother indifferent to the most furious strife of factions. Even cyclones have a definite path, and just aside from it, or even at their heart and centre, is peace. So is it in civil war and national commotion. The storm that raged over the land, uprooting venerable trees and shaking ancient castles, when England's mightiest ruler lay dying, seemed to some over-excited spirits to indicate a conflict among supernatural powers. But among Miss Storey's reminiscences that wild day was signalised mainly by the eccentric proceedings of her boy friend, who was jumping now with the wind and now against it, in order to ascertain the force of the blast by comparing the distances he could leap in either direction. The materials for calculation were completed by a farther experiment on a calm day, when the force of the wind was eliminated.







## CHAPTER III.

### A MOTHER'S DISAPPOINTMENT.

**Y**OUNG Newton's attempts at farming and marketing proved to be a conspicuous failure. The servant hitherto employed as manager was probably not over-anxious to surrender his charge, and the young master was only too glad to take advantage of his zeal. An understanding was, therefore, very easily arrived at. On market days the mother had the satisfaction of seeing master and man set off in good time on their business; but the division of labour was not such as she fondly imagined. On their arrival at Grantham, Newton quietly betook himself to his old lodgings with the apothecary Clarke, where he spent the day over his books, while the servant diligently chaffered and wrangled over sales and purchases. It might be supposed, from Miss Storey's recollections of her youth, that the attraction of her company had

something to do with this distaste for business. But we fear that the mists of ancient memory somewhat magnified her influence; for on fine days Newton thought it a waste of time to go so far as Grantham, and, stopping short on the way, would lie under a tree engaged with his books and papers, until his servant took him up again on the return home.

Whether it ever occurred to him that this habitual deception of his mother could not be right, does not appear. Perhaps he thought that, as he had left school and had practically succeeded to his inheritance, he had a right to dispose of his time as he chose. If so, his constitutional desire for peace and quietness would amply account for his method of avoiding argument or remonstrance. But this somewhat transparent hypocrisy could not last very long. An uncle came upon him one day when deep in mathematical problems under a hedge, and, after ascertaining how he was engaged, represented to his mother that it was useless to contend against nature, and that the boy had better go back to school to prepare for entering at Cambridge. To school he therefore returned, among his old friends at Grantham, where he so endeared himself to his master by obvious signs of genius and eagerness in his studies, that there was

quite a pathetic scene when the inevitable parting came. According to the steadfast tradition of the place, the whole of the pupils were assembled on that occasion, and the master with much emotion pronounced a panegyric on his favourite, enlarging on the joy he had found in having such a scholar and on the bright future he anticipated for him. This was in 1661, when Newton was eighteen years old. In that year he entered Trinity College, Cambridge, where Dr. Barrow was then Professor of Mathematics.

He had no sensational career as a student. The system of competitive examinations was not elaborated then as it is now; and however clearly his extraordinary powers were recognised amongst his contemporaries, the future revealer of the law of gravitation certainly did not attain the notoriety of a modern senior wrangler. But he soon attracted the notice of Dr. Barrow, and was early marked out as his obvious successor. His most remarkable achievements as a student, however, were such as no competitive examinations could possibly recognise, because they were too original to be within the scope of a method adapted only to test acquaintance with accepted results. It is well established that he had not yet taken his degree when he hit on the binomial theorem, and also invented

his method of fluxions for the calculation of constantly varying quantities.

Achievements in mathematics are not so commonly appreciated by ordinary readers as are attainments in the science of language; for, whether rightly or wrongly, every articulate animal thinks he must surely know something about the latter. We may say, therefore, that if a lad of twenty had hit upon Grimm's law, and at the same time invented a method of deciphering the Assyrian records, he would hardly have accomplished anything more wonderful than those achievements of the undergraduate Isaac Newton. But even more remarkable was the reticence with which he kept his discoveries to himself. No one knew of them except his most intimate friends, and even those only after some delay. Thus it was not until the publication, in 1668, of a book aiming at the same object, that Newton showed his manuscript work on fluxions to Dr. Barrow; but even then he did not publish it.

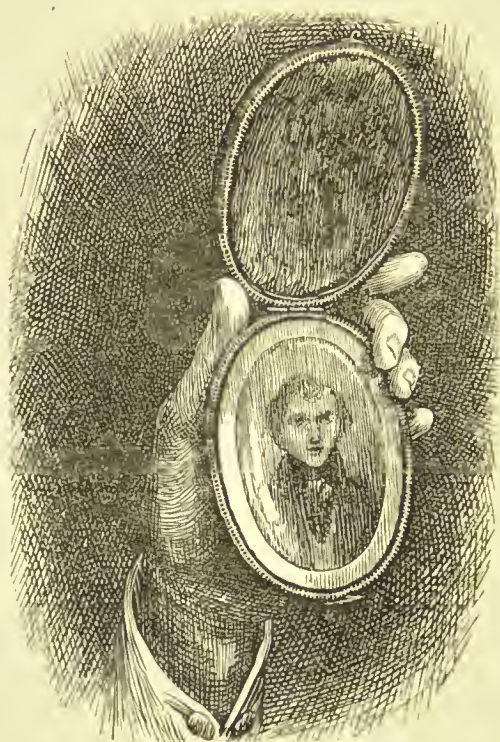
This reticence is so characteristic of the man that it is worth dwelling upon for a moment. In our day facilities for publication are so great, and competition for notoriety is so keen, that every one with a half-formed idea must needs rush into

print, lest he should be anticipated by some one else. The result is, that it is not so much knowledge itself that is valued but rather the credit of it ; and even the best men are in danger of being drawn aside from sound methods by the scramble for reputation. But so far as literature and science were concerned, Newton lived in quieter times. The attainment of knowledge was so constantly dissociated from any ulterior reward that, when cultivated at all, it was much more likely to be cultivated for its own sake than it is now. And the man himself was so constituted that, even had he lived in these days, the scramble for notoriety would have had no attractions for him. Not that he was morbidly humble, or at all unaware of his great powers and achievements ; but to him the joy of making fresh discovery, or of inventing new facilities for discovery, was such that it hardly occurred to him to think of any further reward. He had, therefore, no temptation to premature publicity ; and, on the other hand, it seems pretty clear that he shrank from the personal controversies sure to be aroused by any startling announcement of new scientific truth. Thus it happened that none of his most conspicuous additions to human knowledge were published until years after they had been completely matured in his own mind.



It is interesting to find that even this extraordinary student was not free from the weaknesses of youth. It was his custom to keep in a memorandum book a rough record of his expenditure. Here, under the heading "*otiose et frustra expensa*" ("idly and vainly spent"), we find that he occasionally indulged himself in "sherbet and reaskes," "beere," "China ale," "cherries," "tart," "bottled beere." Then—mingled with such scientific items as "*Bacon's Miscellany*," "three prisms" and "four ounces of putty"—we come upon lump sums vaguely put down to "the tavern several other times," and indications of good-nature like "loans to cousin Ayscough" and "oranges for my sister, 4s. 2d." Pale records these, in faded ink; but what magic power they have over a sympathetic fancy! How they let us into the struggle, that seemed at the time tragic, but now only amuses, between "sherbet and reaskes" or "China ale" on the one hand, and Euclid or Descartes on the other! That entry "at the tavern several other times,"—does it not huddle up in a shame-faced way reminiscences of more than one weak moment? There is no suggestion, indeed, that even in his youth Newton ever exceeded the bounds of temperance; but the heading "*otiose et frustra expensa*" shows clearly enough that the

young philosopher had sometimes reasoned with himself in vain. And then poor "cousin Ayscough"! What a story of extravagance or impecuniosity is told by that plural "loans"! Four shillings and twopence was surely rather a large sum to spend on "oranges for my sister;" it suggests a return home to Woolsthorpe for "the long," and an anxiety to make the meeting as happy as possible on all sides.





## CHAPTER IV.

### THE FALLING APPLES.

**I**N 1665, when Newton was twenty-two years old, the year of his degree, the visitation of the plague dispersed the members of the university. At that time he was concentrating his attention on the laws of accelerating motion, and on this subject he continued to work and meditate during his retirement. As he lay beneath a spreading apple-tree, an over-ripe apple parted from its stalk, and fell with a thud on the sod beside him. The course of thought started by this commonplace incident ended in the widest and grandest generalization that the human intellect has ever achieved. But let us not exaggerate the part of the falling apple. The incident itself is tolerably well established; but its place in Newton's discovery has been much misunderstood. Some people talk as though the notion of an

attraction between solid bodies had then first been suggested; and others would like to treat the incident as mythical, because it is absurd to suppose that so magnificent a reasoned conclusion should have been dependent on so insignificant and ordinary an occurrence.

But there is misunderstanding here on both sides. The idea of an attraction between the various orbs of the universe was by no means new. Both Copernicus and Kepler had speculated upon it; but all this had only been vague surmise. What Newton did was to define precisely the manner in which this attraction acted, and to show that all the movements and even the apparent aberrations of the heavenly bodies were in accordance with calculations based on the law he enunciated. Of course the phenomena of weight were familiar to every one, and no one had ever doubted that the planets must have a considerable weight; nay, it had been conjectured that the moon was only kept from falling into the earth by the centrifugal force of her motion in her orbit. But Newton announced, in clear and definite terms, *that each portion of matter attracts every other with a force that is directly as the mass and inversely as the square of the distance.* This is a law so comprehensive that absolutely no exceptions to it have

ever been observed, and the presumption rapidly increases that no such exceptions exist. It is so definite and exact in its terms, that no difficulty is found in applying it to any relations of heavenly bodies at all calculable ; and it is thus a key to all the massive movements of the universe.

Nothing illustrates Newton's self-control in speculation, and his great-souled patience in the pursuit of truth, more strikingly than the story of the dawn of this discovery upon his own mind. When the apple struck the ground, he began to ask what could be the nature of this force, by which all things were drawn with rapidly quickening speed to the bosom of the earth. How far off did it operate ? The fact that it was an accelerating force suggested that it must diminish in some ratio to the distance at which it acted ; but at the top of the highest mountain there was no sensible difference in its power. Did it reach to the orbit of the moon ? Surely it must ; for what else could counteract the centrifugal force by which the moon, in her revolutions round the earth, must always be tending to fly off ? And here a glimpse was opened of a new vista of inquiry. The true law of this force of weight must be such that, at the distance of the moon, it exactly counterbalances the centrifugal force. Now,



if he could find what ratio of diminution would satisfy this condition, he would have a complete statement of the law of gravitation. Obviously there must be some connection between the speed with which the planets travelled and the force that held them to the ruling orb. But Kepler had shown that the squares of the times of different planets were as the cubes of their distances; and this suggested to Newton that the force of gravitation might diminish just in proportion as the squares of the distances increase.

When once this stage had been reached, many a neophyte in discovery would have felt like a child whose new penny burns a hole in his pocket. If he dared not publish it to the world, at least he could not keep it from sympathetic and admiring friends. Yet if Newton had gone no farther than this, he would have added nothing whatever to human knowledge of the subject. He would have added another to the numerous guesses on the question—that would have been all. But to Newton, even more than to Bacon, we owe the great principle that without verification there is no truth for man. What he had to do, then, was to calculate what the weight of the moon would be at the distance of her orbit, on the supposition that the weight of the same mass decreases as

fast as the square of its distance from the earth increases. He must then ascertain the centrifugal force that is always tending to draw the moon's path out into a straight line. Then, if it should turn out that the diminished weight exactly balanced the centrifugal force, the proposed law of gravitation would be proved—at least in the case of the moon; and the conditions of mechanical relation being manifestly the same between the sun and the planets as between the earth and the moon, a presumption of overwhelming strength would be raised that the law would stand good in their case also.

All the calculations necessary were simple enough to a mathematician such as Newton. We can imagine his anxiety as he approached the last step, and cast the balance of the opposing forces; and we can sympathize with his disappointment when he found that they would not balance at all! The force of gravitation, according to his new law, would be apparently one-sixth too great, and would of course have pulled the moon into the earth. With a courage worthy of his intellect, he at once surrendered the theory that had delighted him, or at least concluded that some unknown circumstance must interfere with its working. He was not the man to boast a theory he could not prove;

and therefore for years it was buried in the loneliness of his own thoughts. The fact was that the real distance of the moon had never yet been accurately ascertained, and all his calculations were disturbed by his unavoidable acceptance of the common statement.





## CHAPTER V.

### THE COURAGE OF SILENCE.



E have treated Newton's surrender of his theory as an act of courage. A French writer takes a very different view. "This weakness of a great genius," he says, "has not been sufficiently noticed.

It cannot be denied that Newton was wanting in the sturdy faith, the unconquerable conviction, which inspire and sustain discoverers. This principle of attraction, so well calculated to take strong possession of a great mind, even regardless of all mathematical considerations, was rejected by him the moment he saw it to be inconsistent with his reckoning. . . . How we should have liked Newton to cry out at the end of his calculations, 'Still for all that, the earth does attract the moon in the inverse ratio of the square of the distance!' " \*

\* "Savants du Dix-huitième Siècle," par L. Figuier, p. 23.

Such a sentiment is surely very French. It amounts to much the same thing as "so much the worse for the facts!" There seems to be some confusion here between the inspiration of a moral purpose and preconceived opinion as to the physical order of the world. The former makes a prophet, the latter a mere visionary. And the difference between the two does not arise from any distinction between faith and science in regard to ultimate dependence on facts. But the facts of the one are determined by "the evidence of things not seen," and the facts of the other by the direct observation of the senses. Both alike are the outcome of experience, but experience of a very different range. The experience in which faith rests includes the whole history of the moral consciousness of mankind, in sin and suffering, in repentance, aspiration, and triumph. The range is so vast that particulars are forgotten and induction is unconscious rather than conscious. Faith is obedience to the noblest instincts of a hundred past generations, passing over into a present impulse of the soul to choose the better part. Such is the faith which is sturdy in strife and unconquerable in conviction, even when gainsaid by plausible appearances. But then it has to do with things moral and spiritual, not physical. On the other hand



opinion about the physical order of the world is dependent on a very different and a much narrower range of experience. It does not appeal to the slow growth of millenniums, but to the observations of the last two or three hundred years ; and it deals with what can actually or conceivably be made evident to the senses. Its subject is palpable fact ; and if palpable fact contradicts it, it is gone, like a bubble at the touch of a rock. A servant of God may hold undauntedly that God's service is the only way of blessedness, though every feature in his outward circumstances may seem to contradict him. But then he is speaking of things inward, which eye hath not seen nor ear heard. On the other hand for Newton to hold to his theory of gravitation, when, so far as he could see, facts contradicted it, would have been to grasp in his right hand a lie. And it was not want of faith, it was a noble moral courage which surrendered the pride of discovery until the facts were understood.

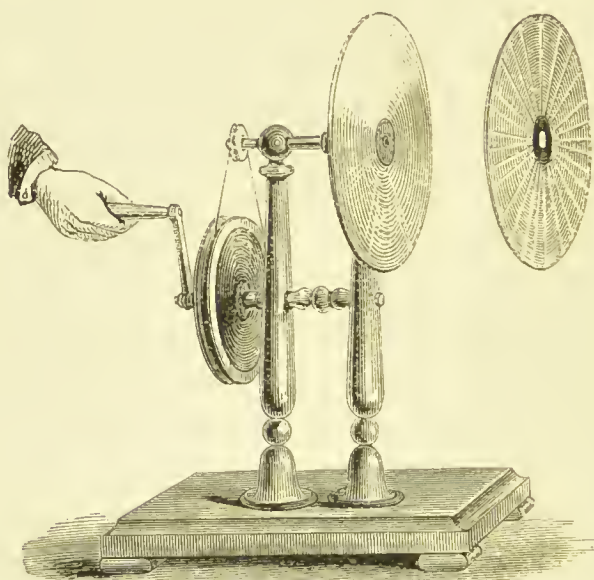
For this Newton had to wait a long time. His theory was conceived, as we have seen, and his first ineffectual effort at verification was made, in 1665, before he was twenty-three years old. But it was not until seventeen years afterwards, in 1682, that the secret of his failure was revealed to him. In the meantime he turned his attention

to other subjects, and within about a year solved the mystery of the prismatic colours, by showing the complex nature of light. On that discovery, however, we cannot dwell. It happened in the later year above mentioned, that Newton was in the ante-room of the Royal Society, listening to the scientific gossip of the day. And amongst other news, his friends were talking of certain new measurements of a meridian line made by M. Picard in France. One result that followed was an important correction in the estimated length of the earth's diameter. And as the distance of the moon had been reckoned at so many diameters of the earth, it followed that in his former calculations seventeen years before, Newton had been dealing with false data. It was then still possible that his theory of gravitation might be correct. Nay, it seemed probable; for the result he had formerly reached was that the force of gravitation would be one-sixth too great according to his theory. But if the moon was so much farther off than he had supposed, his results as to the force of gravitation should have been proportionately less.

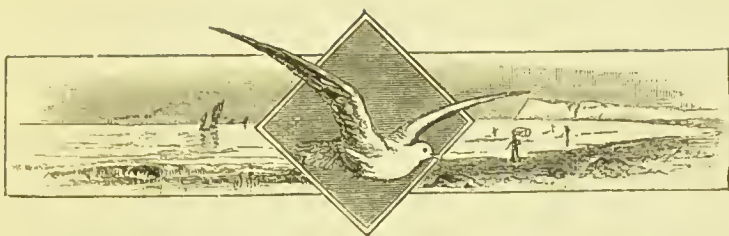
All this passed through his mind in the few moments that he stood abstracted amidst the hum of conversation. It is not probable that he took any part in the philosophical proceedings that

evening. Making a note of M. Picard's new results, he hastened to his lodging, and instantly began fresh calculations. It became more and more evident, as he proceeded, that the conclusion could not be far from his anticipations. But the vastness and comprehensiveness of the generalisation dependent upon his figures agitated his mind beyond even his power of self-control. Habitually calm and unimpassioned as he was, he was stirred to his inmost soul by the thought that his hand was on the curtain which veiled the secret spring of infinite and everlasting movement. Such was his agitation that he felt he could not trust his own figures, or rather, perhaps, the greatness of his emotion made the detailed processes of calculation impossible. He therefore obtained the aid of a friend. The work was thus finished. The fact stood revealed. With the corrected statement of the moon's distance Newton's suggested law gave to our satellite precisely the weight necessary to balance the calculated centrifugal force ; and the interaction of the two clearly accounted for the moon's continuance in her orbit. But this was comparatively little. For it was impossible to suppose that this law applied only to the relations of the moon and the earth. The conditions being obviously the same, the law would also explain the relations of other planets to

their satellites, and also of the sun to the planets. Nor did the range of the discovery stop here. There was no moving body in space which did not possess mass, and if mass, then proportionate weight, or power of attraction over other masses. But wherever this power existed, the newly discovered law would be applicable. Thus a few feeble words of a mortal man unveiled the mechanical system of the whole universe.



Newton's Revolving Disc for recomposing Colours into White Light.



## CHAPTER VI.

### A LIFE OF PEACE.

**T**his is not within the scope of the present sketch to attempt a biography of Newton. It may suffice, therefore, to refer to the chief features of his life which illustrate or obscure his character. For twenty-six years, from 1669 to 1695—that is, from the age of twenty-six to fifty-two—he was professor of mathematics and optics at Cambridge. During the whole of that time he was in constant residence, except during a part of the long vacation and the intervals occupied by occasional visits to London. His remuneration was small, but his duties were comparatively light, being limited to one lecture and four hours of classes during the week. He thus had ample leisure for meditation, study, and experiment, a privilege which, to a man of his nature, was of inestimable worth. In 1671 Dr. Seth Ward, Bishop of Salisbury, who had probably



heard from Dr. Barrow something of Newton's method of fluxions, proposed him as a member of the Royal Society. He was elected in the following January, and on that occasion communicated a description of a reflecting telescope, and also a model of his own construction. There has been almost as much dispute about his claim to be the inventor of this instrument as about Galileo's right to the credit of the ordinary telescope. In both cases probably the truth is that the invention was "in the air," and that while it occurred to contemporaries, the originality of genius was necessary to discern its real value.

In a second communication of the same year, Newton described his discovery of the complex character of light, and his letter acknowledging the thanks of the society for this paper is exceedingly characteristic. He had hitherto published nothing whatever ; but he allowed this discovery to appear in the Transactions of the Society. "Believe me," he wrote to the secretary, "I not only regard it as a duty to join with the other members in the advancement of scientific knowledge, but I consider it also a great privilege, that instead of exposing discoveries of this nature to the irreflexion of a prejudiced and curious mob, by whom so many new truths have been vulgarized and destroyed, I

can address myself to a society as impartial as it is enlightened." Yet, much as he valued such a connexion, the necessary payments, though they could not have been large, were a serious burden on his small resources. Whatever could be spared from the necessities of life he needed for books and apparatus. He therefore sent in his resignation. But the real cause could not be concealed, and he was persuaded to continue his membership, with the understanding that no subscription should be expected other than scientific communications. And from such a man these were worth more than all the funds of the society.

In those unreformed days holy orders were an essential condition, if not for entering upon, at least for retaining, all academic dignities. But, as we have seen, Newton had an unconquerable repugnance to ordination, and Charles II., who viewed such matters with easy indifference, interposed his royal authority to dispense with this necessity in the case of so promising a young professor. But royal favours did not make a courtier of him. For in the next reign Newton took a prominent part in the resistance of the university to James's attempt to secure a somewhat similar, or at any rate analogous, dispensation for a Benedictine monk. The King insisted that this monk should be admitted

Master of Arts without taking the oath of supremacy, which was contrary to his conscience. But people are seldom or never logical in their advocacy of liberal principles. And Newton, who had been quite ready to accept a dispensation for himself, resolutely opposed the exercise of a similar power in this case. No doubt it may be said in his defence that in the latter instance the attempted exercise of the royal prerogative was only part of a scheme for revolutionizing both Church and State. However, his conduct in this affair gained him the confidence of the whole university, and in 1688 he was sent up to Westminster as one of its representatives in Parliament.

Throughout the eventful crisis of that year and the following, and down to 1695, he retained his seat. But it is stated that during the whole of that period he never opened his lips in the House but once, and then it was to ask that a window might be closed, because of an unpleasant draught. We wonder what honourable members thought of their silent colleague. His fame was too widely diffused by that time to allow them to regard him as an ordinary dummy. And if the proverb about cutting blocks with a razor occurred to them, they would scarcely consider it respectful to themselves.

In 1695, however, he exchanged his professorship at Cambridge for a permanent place of profit in the gift of the Government. This is the one part of Newton's career which at first sight appears scarcely worthy of the high position he held in the intellectual world. But posthumous and contemporary judgment occupy very different points of view, and on matters like these the latter is often misled for want of a true feeling of the situation. Shakspeare was still comparatively young when, on the strength of his London gains, he settled down in comparative idleness at Stratford, and smoked his pipe comfortably at the public-house like a successful pork-butcher who had earned a rest. Do we on that account detract anything from his transcendent genius? No; we say he had so much human nature in him that we can very well understand his enjoyment of his pipe and glass, and gossip even about bullocks. In fact, transcendent genius is sometimes a good deal more commonplace in its ways than are its second-rate imitations. And so the creator of the grandest generalisation ever made in physical science, never, so far as we know, affected any contempt for money or what money will bring.

Undoubtedly his first love was knowledge; nor is there any reason to suppose that he

ever deserted this. But at fifty-two years of age the virgin freshness of youthful impulse was becoming a distant memory. To whatever cause we may trace the fact, the age of discovery for him was past. It remained only to mature his additions to human knowledge. But his income was very small—not as much as many an elementary school-master receives in these times—and he must have been much hampered in his researches by this cause. At this juncture the post of Warden of the Mint was offered to him, and accepted. A few years afterwards he was promoted to the place of Master, with a salary of £1,500 a year. If there were any reason to suppose that the astronomer had sacrificed higher ends to the comfort of his declining days, we might regret it, even if we did not blame him. But there is no evidence of the kind. Had he consented to ordination in his younger days, he would at fifty or sixty have been made a bishop. As he had not done so he was made Master of the Mint instead; and we do not know that astronomy has more to complain of in the actual case than it would have had in the supposed one. In this honourable retirement he lived till March 20, 1727, when he died at the age of eighty-five years.





## CHAPTER VII.

### CHARACTERISTIC ANECDOTES.



IN Isaac Newton's chief discoveries and ideas are embodied in his great work commonly known by an abbreviated title as the "Principia." It is mainly an exposition of the mathematical principles governing the mechanism of the universe.

The work consists of three parts. It first deals with the laws of motion, then with the principles of dynamics, and, finally, with the application of these to the system of the world. In this last section the universal law of gravitation is expounded. This book was presented in manuscript to the Royal Society in 1686, and was published in the following year at the Society's expense. It was the first production of any size that Newton gave forth to the world. The fact that its author was forty-four years old when it was published, and that he had taken twenty-one years to mature the great doctrine which was its chief motive, suggests

some salutary reflections on the impatience of modern youth. The treatise on Optics did not appear till 1704 ; but its doctrines had appeared previously in various fragmentary papers. Of course Newton's discoveries, demonstrably true as they were, had to encounter much opposition. But, for reasons suggested in the opening of this sketch they did not excite theological bitterness. Newton's persecutors were scientific men, and we cannot help suspecting some of them of an envy entirely inconsistent with singleness of eye for any truth, whether moral or material. Other writings of the great astronomer have fallen into comparative oblivion.

Of such a long and conspicuous life many anecdotes are naturally told, and if they seem to illustrate a character established on other grounds, we need not inquire too curiously into their evidence. His physical appearance at any rate has been preserved to us by authentic portraits as well as loving descriptions. He seems to have united, in an unusual degree, brightness of eye with serenity of face, a combination that suggests keenness of interest without restlessness, and repose without apathy. He was simple in his modes of life, and for the most part solitary. He had an immense power of abstracting himself from his immediate



surroundings, and of concentrating all his powers on one line of thought.

But sometimes this power mastered him, instead of being held at his service, and then the effects were occasionally strange. It is said that if a thought struck him in the course of dressing in a morning, he would pursue it for hours seated on the side of his bed, hose or shirt in hand, and only when the problem was solved would it occur to him to finish the process of attiring himself.

It is related that his friend Dr. Stukeley, being invited by him to dinner, was introduced to the dining-room while Newton was still in his study. The doctor waited patiently, making all allowance for the importance of the calculations on which the philosopher was probably engaged. But at length the dinner having been placed on the table, and appetite getting the better of patience, he made bold to carve a fowl, and replaced the cover on the remains. Some time after his guest had finished Newton came in, and remarking that he was very hungry, sat down to the table and took off the cover. Nothing but fragments being discovered, "Why!" he exclaimed, "I thought I had not dined yet; but I see I was mistaken."

The story of the destruction of his papers by his little dog Diamond is well known. He had left a candle burning on his table when he went out to evening service in the college chapel. The little dog overthrew the candle, and a number of precious notes, the result of long years of labour, were consumed. "O Diamond, Diamond!" he cried, when he came in and saw the ruin, "little you know the mischief you have done." The incident is generally related as illustrative of his calm self-control. But if he said little he felt much; and it has been surmised that the loss

seriously depressed his spirits, and for a time deranged his bodily health.

Yet, on the whole, he knew little of sickness until his closing years. Then slowly, but too plainly, the symptoms of a painful disease became apparent. In the paroxysms of anguish, the clammy sweat gathering on his drawn face told of his terrible endurance. But he would not suffer himself the relief of a cry, nor did any sign of impatience escape him. His spirit was like that of Robert Hall in a similar trial : " I haven't complained, sir, have I ? And I won't complain." But Sir Isaac Newton did not express it in words. His endurance, like his thought, was clothed in silence. And then, when moments of alleviation came, he talked once more with those about on any topic that interested him, and with all his usual quiet grace. Till within twenty-four hours of his death he was in full possession of consciousness and sense. Then the cloud of insensibility fell, and in that cloud he passed into eternity.

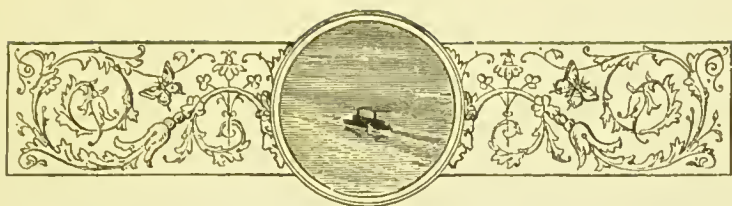
What monument does the man require whose name rises to memory every time we gaze on a sailing planet or watch a falling star ? Westminster Abbey enshrines his body, and the record of his achievements ; but we do not go there to be reminded of him. The inscription beneath his



statue at Cambridge is fondly exaggerated: "Qui genus humanum ingenio superavit" ("In genius he overpassed the race of man"). No; there have been men of even vaster powers of intellect. But the times were ripe. His inward eye was keen. His spirit was calm. His mind was open to the truth. His soul was hallowed by reverence. And so God made him the high priest of the starry temple, the prophet of the order of the world.



Royal Society's House in Crane Court, Fleet Street, London.



# DENIS PAPIN.

## CHAPTER I.

### THE FIRST STEAM-BOAT.



STUDY of the story of human progress, and of the melancholy way in which mankind have treated the men whose discoveries and inventions have led that progress, suggests no more natural and just reflection than that of Bildad the Shuhite: "We are but of yesterday, and know nothing." The story of Denis Papin will well point this inspired reflection; and may help to a lowlier thought of self in this self-sufficient, conceited age.

Whatever may be the claims of John Fitch, Robert Fulton, and others to the credit of having first made steam a practical power in navigation,

it is certain that the first actual steam-boat sailed down the river Fulda in the year 1707, bringing its voyage to a disastrous end at the junction of that river with the Weser. This wreck was the work neither of storm nor eddy, nor of any hostile forces of nature. It was wrought by forces springing from the evil in human nature itself, far more inimical to the progress of humanity than any adverse influences which weaklings bewail in the external world. This first steam-boat was broken up by the selfishness and prejudice of a trades-union of boatmen, who had the satisfaction of delaying the progress of steam navigation for at least a century. They had their reward, such as it was ; but their stupid victory and the misery of their victim, the constructor of the boat, together form a tragic picture impossible to contemplate without some useful lessons and possibly inspirations of patience.

The builder of this primitive steam-boat was Denis Papin, a French Protestant, who had wandered thus far away from his native home in Blois, after vainly seeking in London and in Venice an opportunity for developing his mechanical genius. His family had been Protestants for more than one generation, stern Calvinists in a time when Non-conformity required some hardness of fibre. He

was born in the year 1647, nearly twenty years before the fire of persecution was kindled that blasted for generations the noblest fruits of French genius in science and in commerce. His father was a physician, and Denis was intended for the same profession. It could not have been very profitable to his father, for in 1669, when the young man passed his examinations at the Protestant academy of Angers, he was unable to pay his fee, and was indebted to the faith of his examiners, who trusted him to pay it when he could.

It is said that he practised as a physician for two years. Whether his profits enabled him to pay his trifling debt we do not know ; but they could not have been very large, for he gratefully accepted an offer of the celebrated philosopher Huygens to come to Paris and act as his assistant. Here he obtained the post of curator, or experimenter, or both combined, under the recently established French Academy. One of the first objects of research proposed by Huygens to his colleagues was the weight of the atmospheric air, and the mechanical effects to be obtained by means of a vacuum. In 1674 Papin published a little book detailing his experiments on this subject. This was brought to the attention of the minister Colbert. He, however, looking upon it only as a description of

curious recreations or scientific trifling, regarded it as possessing no interest for "practical" men. The fact that this "trifling" suggested the first germs of an invention that has revolutionised the face of the earth ought to be a warning to similarly "practical" men at the present day.

In the following year, 1675, Papin went to London. The reason of the change is not known, but in all probability it was connected with his religious position. A young man stigmatized as a heretic could scarcely be happy in a society where Romanism was one of the essentials of respectability. Huygens himself, though not particularly scrupulous upon the subject, found his position intolerable, and in a few years afterwards withdrew to Holland. The young Frenchman carried with him to London letters to Robert Boyle, the most prominent among the founders of the Royal Society. After some little time, passed not without pecuniary embarrassment, Papin was engaged by the Royal Society in a position somewhat similar to that which he had occupied in the French Academy. In this position Papin contentedly remained for several years; during which he continued his experiments on the weight of the atmosphere, and also on the powers of steam.

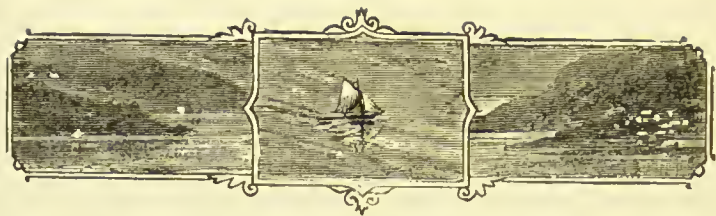
During this period he invented a sort of boiler,



or digester, which by means of superheated steam extracted every particle of nourishment from bones and other materials not directly digestible by the human stomach. This was the only invention of his that ever came into general use, but it does not appear that he himself gained any considerable profit from it. The most interesting feature in it was the safety valve, which in its essential principle was the same as that afterwards applied to steam-engine boilers.



Fulton explains his invention.



## CHAPTER II.

### A WANDERING GENIUS.



**T**N 1681 Papin went to Venice, apparently at the solicitation of the Venetian ambassador ; but, not gaining anything by the change, he returned to his old position in England three years afterwards. About this time he produced a scheme for conveying to a distance the mechanical power of falling water. In our own day we are told that this is possible by means of electricity. But Papin's idea was to make the falling water work an air-pump of his own invention, by means of which a vacuum was created in a long tube extending to the scene of operations. The pressure of the air through this tube, on the principle afterwards applied to the atmospheric railway, was the power by which he produced the mechanical motion required. The working of his scheme was exhibited in London ; but the machinery had not been well constructed,

its operation was defective, and the consequence was disappointment and failure.

Another change was now affected in his fortunes, which gave the promise at least of additional dignity though not of wealth. In the picturesque little town of Marburg, in Germany, a small colony of French Protestants had been established, having been driven from their own homes by the suicidal bigotry of their native land. Amongst these was the widow of Denis Papin's uncle, a Huguenot pastor. This good man had suffered in his lifetime the double misery of hostility from outsiders and suspicion from the members of his own Church. For, being a man of somewhat liberal views, he was believed to have an inclination to a doctrine of tolerance too wide even for the members of a persecuted sect. The shadow of the suspicion attached to his name rested upon his surviving widow, and even upon his children. One of the daughters was herself a widow with one little girl. It is said that this daughter had been a playmate of Denis Papin in childhood, and it is possible that an early attachment may have been nipped in the bud by the far-away wanderings which were her cousin's lot in life.

However that may be, it was probably through some family influence that the reputation of the

young French mathematician was brought to the notice of the Landgrave of Hesse Cassel. This potentate invited him to take the chair of mathematics at the University of Marburg. The emoluments were scarcely larger than the modest sum that he was receiving in London, but living was much cheaper in the little German town ; and it is not improbable that family affliction, or perhaps something stronger, united with an innate love of wandering, determined his acceptance of the office. At any rate he had not assumed the position very long before he married his cousin, much to the annoyance of the Protestant pastor, who had scruples about the nearness of the connexion, and a much stronger objection to the doubtful orthodoxy of the family. Indeed, the marriage was delayed for some time by the difficulties thus occasioned. It is to be hoped the marriage added to the happiness of the wanderer, for certainly it very much increased his difficulties. He now became responsible for the maintenance of a considerable household, and the income of his chair did not realise even his limited expectations.

From his original pursuits, however, his devotion never varied. He was still intent upon the mechanical resources obtainable from the weight of the atmosphere, through the means of an artificial

vacuum. His idea now was to obtain this vacuum by the explosion of a small quantity of gunpowder in a cylinder beneath a movable piston. The sudden expansion of the gases generated was to drive the piston upwards, and the pressure of the air on the dispersion of these gases was to drive it down again. He constructed a model to illustrate his idea and published a book upon the subject. But the practical effects were not equal to his expectations. This was in the year 1688. It now occurred to him that his vacuum would be better obtained by the alternate generation and condensation of steam; and within an interval of two years, that is, in 1690, he read a paper to a philosophical society of Leipsig, in which he explained his theory.

It is difficult without diagrams to give an idea of a strange machine which has no parallel at the present day. But the fundamental notion of Papin was so simple and rude that it may, perhaps, be made intelligible in words. Imagine a cylinder of iron closed at bottom, and with a movable piston. Water having been poured into the bottom of the cylinder, a fire is then lighted around it. The water being heated to boiling, the expansion of the steam drives the piston upwards to the top of the cylinder. The fire lighted in the movable furnace



is now removed, the steam is condensed, and the superincumbent atmosphere drives the piston down again to the surface of the water. The fire being once more applied at the bottom of the cylinder, steam is generated again and the same movements are repeated.

Papin relates that though he worked with a model having a piston of only two and a half inches, the downward pressure of the air raised a weight of sixty pounds; and he calculated that by a very moderate enlargement of the cylinder weights of two thousand pounds could be raised. The movements given by a single cylinder of this kind would be discontinuous and spasmodic; but by a development of his plan, no less rude than the original idea, he proposed to employ several co-operative cylinders, and to move the fire about from one to another in succession. By another modification he moved the cylinders instead of the fire, finding this to be more practicable. How this plan was rendered practicable we cannot explain, because sufficient details are not given in the papers the inventor has left. But it is certain that this was the fundamental principle of the engine by which he propelled a boat on the river Fulda a very few years afterwards.



### CHAPTER III.

#### A TRAGEDY.

**I**N 1695 he went to Cassel. The ostensible reason for his removal was the desire of the Landgrave to employ him upon some engineering works he had in hand. But there were other reasons which, if they did not actually drive him away from Marburg, at any rate made him glad of an opportunity for leaving. The Protestant pastor, who must surely have been a very narrow-minded man, brought his controversy against the deceased M. Papin to an issue by excommunicating his whole surviving family and all their connexions. Great was the scandal occasioned by this squabble amongst religious exiles, who stood in special need of social harmony and mutual support.

One purpose which the Landgrave had in view in summoning Papin to Cassel was to employ his mechanical ingenuity in raising water from mines

more expeditiously than had hitherto been possible. In constructing engines for this purpose the inventor made some improvements in the rough methods he had previously used. He appears to have discovered that the direct action of the steam might be made available as well as the pressure of the atmosphere. In a letter to Leibnitz he says, "In addition to the vacuum I avail myself also of the pressure that water in the course of expansion exerts upon other bodies. . . . As I believe that it is possible to employ this invention for many other purposes besides the rising of water, I have made a model of a little carriage which is moved by this force, and it acts precisely as I anticipated. . . . I believe that the roughness and the sharp turns of our highroads make it exceedingly difficult to perfect this invention for land carriage; but for carriage by water I have great confidence of speedy success if I had more help than I possess." This is a very striking passage, and shows clearly enough that poor Denis Papin was quite aware of the immense future which lay before the invention he was endeavouring to perfect.

But, alas! there remained but little future for him in this world, and that of pitiable disappointment and misery. When in England he had seen a boat propelled by revolving paddles moved by

horse-power. This boat was, we believe, the invention of Prince Rupert. Papin borrowed the idea of the paddles, but instead of horses employed his infant steam-engine to turn them. The boat he thus constructed was undoubtedly a remarkable success, considering all circumstances. He relates with glee, to his great correspondent Leibnitz, how it had been tried on the river at Cassel, in the presence of the Landgrave, and how its power was so great that it seemed to make little difference whether it sailed with or against the stream. But this was the extent of his triumph. A misunderstanding with the Landgrave about his pumping engines ripened into a quarrel which determined Papin once more to take refuge in England.

The difficulty now was how to convey his precious invention thither. If he could only sail his boat down to Bremen, he might there trans-ship the engines and have them conveyed to London. But for this purpose it was necessary to surmount the network of obstacles opposed by corporations of boatmen to the free passage of the Fulda and Weser. For some time Papin hoped to obtain an authoritative pass from the Elector of Hanover; but he was pressed by pecuniary difficulties, and delay became intolerable. He met with a boatman who professed to give him a document which

would secure his passage into the Weser, and, trusting to this, he embarked his fortunes and his family on board his novel craft. So far as Loch, at the junction of the Fulda and Weser, all went well. The boat ran rapidly down with the current, startling the sleepy villagers with its beating paddles, and perhaps exciting their superstitious fears by its uncanny appearance.

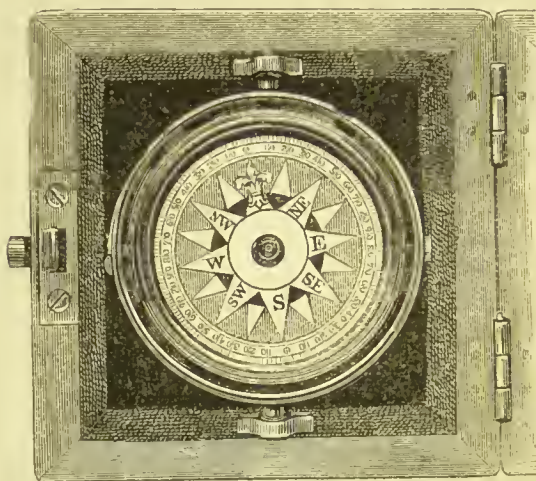
At Loch it was necessary to stop until arrangements could be made for a farther passage. The document with which Papin had armed himself proved of no avail. The boatmen were on the alert; they insisted upon the preservation of their monopoly. It is possible, and, indeed, probable, that a fear lest this magic engine should supplant human labour added to the energy of their opposition. In vain Papin protested. In vain he appealed to the curiosity and the sympathy of an emissary from the burgomaster of Münden, to whom he explained the fruits of his ingenuity and toil. The stolid boatmen insisted upon their rights. They required the machine to be made over to them; and before many hours had elapsed they cut the matter short by dragging the machinery out of the boat and shattering it in fragments before the eyes of its agonized maker. From this blow Denis Papin never recovered. Sending his family

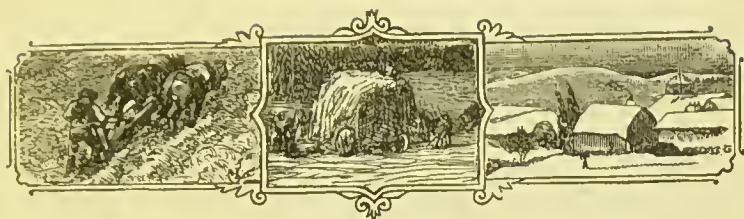




Destruction of the Boat.

back to Cassel, he went, a lonely and broken-hearted man, to London, where once more he obtained subordinate employment. His genius was henceforth wrapped in clouds of descending night; and not to his eyes was it ever given to behold the rise of the brighter day which the triumphs of steam have opened to the world.





# THOMAS CAMPANELLA.

---

## CHAPTER I.

### A JUVENILE PRODIGY.



THOMAS Campanella was born at Stilo, a small Calabrian village, in 1568. He came into a world intellectually quickened by the revival of Greek learning, but sorely troubled by religious dissension. Yet the dissension was healthy, for it was a revolt of the reviving energies of truth against oppressive corruption. Probably neither the revival nor the struggle much disturbed the sleepy air of remote Stilo. Nevertheless, the boy seemed by an inborn instinct to feel the stir in the great world far away, and he made such progress in his probably monastic schooling that at thirteen



years of age he was reckoned a prodigy of skill in Latin.

His father intended him for the law. In this purpose he was perhaps wiser than he knew, for the Church was then a perilous arena for those who had brains and must use them honestly. But Thomas did not care for the law. He had a dreamy, speculative soul, repelled by the dust of dead words. He was attracted by the idea of mystic contemplation associated with the monastic life; and, regardless of his father's wishes, he sought the protection and society of some neighbouring Dominican monks when he was only fourteen years of age. Under their guidance he was soon lost in the mazes of philosophy, and even left his wondering masters behind. His tutor had made an engagement, common enough in those times, to maintain in public certain theses against champions of the Franciscan order. But when the time drew near he fell ill, and insisted on sending his pupil Campanella in his place. The lad,—for he cannot have been more—showed such knowledge, readiness, and eloquence, that his adversaries were thrown into the shade, and the audience were both surprised and charmed. We sometimes think that boys are very pert and forward in these days; but a lad of nineteen or twenty bearding reverend

doctors in their own domain of learning is happily a spectacle not likely to be witnessed. Indeed, we are often puzzled by the stories that come down to us of juvenile precocity in those old times. If the truth were known, we are bold enough to think such cases show the narrowness of the circle within which erudition was confined, and perhaps also the superficiality and wordiness of the debates in which these disputants shone.

After this exploit it was thought desirable that so promising a genius should turn his attention to theology. But, though there can be no doubt of Campanella's devoutness, this was a study which did not attract him. The probability is he felt its separation from philosophy to be somewhat arbitrary, and its terminology as used in that age to be unreal. He therefore kept to philosophy, and soon had to pass through a crisis of belief. His difficulties were not of a religious but of a metaphysical character, and were too abstruse for examination here. Aristotle was the accepted philosophical master of the Middle Ages, which were just then merging into the modern day. But Campanella, dissatisfied on some points, set himself to read all accessible commentators on Aristotle, and finding them often mutually contradictory, carried his researches into the teaching of Plato and

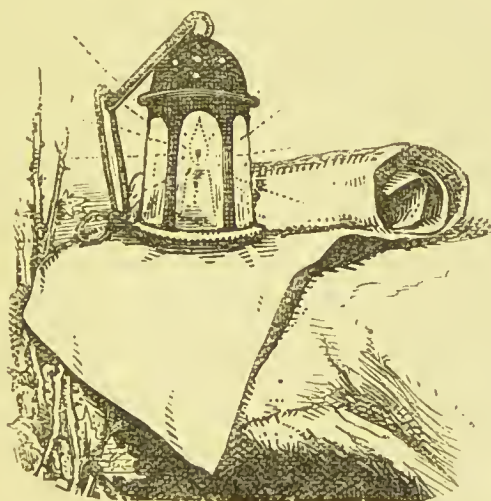


the school of Democritus, the systematizer if not the founder of atomic atheism. The result of this extensive study was that the young man, unsatisfied by what he read, was seized with an ambition to draw up a doctrine of his own. -

We are led to doubt the thoroughness of his research when we find that he was only twenty-two years of age at the completion of his survey, and that before he was twenty-three he had written a sketch of his own system, which he took with him to Naples in order to find a printer. It would be a mistake, however, to conclude that he was a mere charlatan or sciolist. His works are extant to speak for themselves, and they show, at any rate, a very earnest spirit, and a profoundly reverent sense of the problem of existence. Eagerly adopting Galileo's doctrines—of which he showed himself a far more heroic champion than their author himself—he was moved to awe by the vastness of the universe and the insignificance of the individual man. And this imparts a vein of mysticism to his thoughts not unlike the dreamy contemplations of the "Friends of God."

In a treatise called "Atheism Overthrown," he says that all false sects are traceable to the proud scepticism of leaders (or rulers) who think there is no such thing as truth. "And this they think

because they make the part of more worth than the whole, themselves of more value than the human race—nay, than God himself.” Then follows a quaint illustration, foreign to the taste of superfine days, though its translation may be tolerable for the sake of the light thrown on the meaning of the writer. This debasing conceit, he urges, dwarfs all things of majesty as “though a parasitic worm, ensconced in the entrails of a man, should count the man as nothing compared with itself, but only an empty vessel devoted by fate to the nourishment of its own life, and should suppose that beyond its habitat there was no world, no God ; and accordingly, should fancy there was only itself to please.”





## CHAPTER II.

### A BOLD REVOLUTIONIST.



THE circumstances in which Campanella wrote the words just quoted were a sore trial of the self-abnegation he taught. For his life took a sudden turn downwards into horrible depths of darkness that buried him from human sight and sympathy for more than a quarter of a century. And this is how it came about. At a public disputation, not long after the printing of his first work, he had the temerity to express approval of the arguments advanced by an old and irritable theologian. But the old man, so far from being gratified, said it was not for boys to intermeddle with such matters. Whereupon Campanella, nettled by the rebuke, declared that young as he was he could yet teach the venerable doctor some things he did not know. And immediately he began to prove to the audience that the

arguments he had in part approved were far from conclusive. He went on to expose fallacy after fallacy, carrying the hearers with him by his brilliant pertness, so that his grey-haired opponent was put to shame. This was by no means admirable in a young man. But the enmity he aroused helped to bring upon him a punishment more cruel than the fault deserved.

The outraged professor accused Campanella to the Inquisition as a practiser of magic, on the ground that only by satanic agency could a mere youth have acquired such knowledge and skill. For the time the charge was ineffectual, though perhaps it suggested the expediency of removal from the neighbourhood. But afterwards the accusation was renewed with dire results. Meanwhile he travelled to Rome, where he was received with favour, and also to various northern Italian universities, lecturing, teaching, and disputing as he went. At Bologna his writings were seized and taken to Rome for examination. But he himself was unmolested; and when some while afterwards he followed his manuscripts he was welcomed and honoured by many members of the Papal court.

In 1598, at thirty years of age, he returned to Naples, and went thence to his native village, where

his father was still living. About this time the Spanish rulers of Naples discovered, or professed to have discovered, a treasonable conspiracy to eject them from their dominion. It was not an ordinary plot of rival claimants to a throne, nor was it the desperate uprising of overstrained endurance seen in many peasant revolts. There was something unusual in this conspiracy; but its real nature is left in a good deal of obscurity. The impression we get from such evidence as exists is that there were concerned in it men of more cultivation and of more philosophical views of liberty than are usually found either amongst courtly intriguers or revolutionary mobs.

The allegation was that large numbers of the regular clergy were concerned in it; and amongst these Campanella was one of the accused. He was charged with having said that the Spanish government was oppressive, that it did not seek the good of its subjects, and that a more righteous rule was needed, founded upon true principles of justice. But graver accusations than this were made. It was alleged that in union with other monks he had schemed a massacre of the court and its officials, whose places he and his brethren hoped to secure for themselves. There is something strange and incredible on the face of such an



accusation. The Romish priesthood are indeed masters of intrigue, as they have proved themselves in many a national crisis that affected their interests. But except in the case of Rome the only political supremacy they have sought has been veiled under decent pretexts of spiritual advice to the secular power. That a set of monks should have sought by direct means of physical force to lead an assault on a government favoured by the Pope, and to seat themselves on thrones of secular government, seems contrary to the analogy of Church history, and altogether beyond belief.

On the other hand, it is certain that Campanella's philosophical studies had led him in the direction of political speculation. He had written already an imaginative essay, called "The City of the Sun," in which he described his notions of an ideal state. It is very probable that in some of the public discussions in which he was engaged, and in many private conversations, he had supported abstract theories of order and justice wholly inconsistent with Spanish rule; nor is it at all impossible that some prevalent discontent with the existing state of things had suggested to him the hope of an opportunity for embodying some of his theories in tangible form. To these thoughts he may have given incautious expression, and this would be

quite sufficient for the charges made against him. It is much more probable that an intrusive foreign despotism, fearing any shadow of change in public sentiment, should conjure up a terrible conspiracy out of heedlessly-uttered political speculations, than that a man, such as we know Campanella to have been, should have belied his whole character by a murderous conspiracy.

We are confirmed in this belief by the fact that no tortures, though prolonged beyond the ordinary possibilities of human endurance, could wring from our hero the slightest admission of his guilt. Such inhuman means are notoriously as capable of convicting the innocent as the guilty. But where guilt exists they are more likely to bring about a garbled confession than to incite heroic silence. Altogether we are inclined to the conclusion that Campanella sympathised deeply with the misgoverned people, and allowed his sympathy to be perceived—that he would have been glad of the opportunity of a political experiment, and was in hopes it might arise ; but we are persuaded that his indiscretion went no farther. This, however, was quite enough to secure his condemnation.



## CHAPTER III.

### AN UNCONQUERABLE HERO.



It is not unlikely that rumours of approaching trouble suggested his retreat from Naples to Stilo. Here early intelligence reached him of his intended arrest. Accompanied by his now aged father, he went down to the sea-shore, and tried to escape to Sicily. The boat they obtained proved to be unmanageable, or their skill was not sufficient for the weather. Accordingly they resumed their melancholy journey along the shore in the hope of finding a better passage. As the danger rapidly increased the old man left his son concealed in a hovel, while he himself went in search of another boat. There is something very pathetic in such a picture. The poor father was probably too ignorant to understand how his learned and famous son could have got himself into such a scrape. He only knew that, so far as he could see, all the

hopes of his affection were blighted. If only the young man would have followed out his plans, and have stuck to the safe career of the law, he might now have been not only famous, but wealthy ; but the boy would have his own way, and this was what came of it. There was, however, now only one thing to be done, and that was to save him if possible at any expense of trouble or danger to his father. Alas ! while the poor old man was pursuing his weary search the officers tracked his son to his hiding-place and arrested him. He was carried to Naples, and very soon brought up for judgment.

He was at this time about thirty-one years of age, and must have been of a strong, vigorous constitution. He needed all his vital force for the trial through which he had now to pass. But if he had possessed the body of a Hercules it would have availed him nothing had he not burned inwardly with something of the spiritual fire that makes the courage of martyrs. In speaking formerly of Galileo and his submission we have allowed that it lies not in frail mortality to condemn him ; but not the less the story of those here and there whom no torments could bend to falsehood rings like a trumpet note through the soul, stirring and gladdening the best energies in us. And such

a man was Thomas Campanella. The charges made against him were not exclusively political. The religious tendencies of his writings were suspected. But the inquisitors were probably afraid to deal with a heretic of splendid reputation, who had a gift of turning all their insinuations and objections into illustrations of their own folly and ignorance.

They had recourse, therefore, to the accusations of magic and witchcraft already made against him by the ancient professor whom he had offended by his wit. "How," they asked him, "is it possible that you so early in life should have obtained knowledge and skill such as are usually possessed only after forty or fifty years of study?" "Sirs," he replied, "I have consumed more oil than you have drunk wine." He added also with quiet dignity, that when he received ordination the words were addressed to him, "Accipe Spiritum Sanctum," "Receive thou the Holy Ghost." If there were any meaning in such a service his body was a temple of the Holy Spirit. How then could he be in league with demons? Such answers show how far he was from a craven temper. He was brought up five times for fresh inquiry, and put to the rack seven times with such severity that all the joints in his body started from their sockets.



Then, all wrenched and torn as he was, he was hung up by his arms, that were twisted behind his back, over a sharp stake that just touched his feet. On one of these occasions he was tortured for forty hours in succession, but never was one single syllable extorted from him in admission of his own guilt or incrimination of others. That any man should have survived severities of this kind to go through the hardships of a twenty-five-years' imprisonment, and yet after all have reached the ordinary term of human life, shows of what endurance human nature is capable when a strong constitution is animated by a courageous soul.





## CHAPTER IV.

### LIGHT AT EVENTIDE.



HE inquisitors, finding all their powers baffled by his impregnable hardihood, consigned him to prison, and left him to lie there. What merciful attentions he may have received there from the compassion of gaolers or friends we do not know. At any rate he recovered strength and found the time to pass very heavily. For at first he was denied both pen, paper, and books, unless, indeed, perhaps the ordinary books of devotion. After a while, however, when the cowards in office forgot the fright they had received through the supposed conspiracy, this stringency was relaxed, and he had freedom to write his thoughts. Amongst the works he produced was the above-quoted "Atheism Overthrown," and also a defence of Galileo. "Noteworthy!" exclaims a French writer, "while Descartes, enjoying his freedom in France, was

committing to the flames his treatise on the universe, because he learned that Galileo was in trouble for his proof of the movement of the earth, Campanella in prison was writing and publishing a book to defend that very truth."

Noteworthy, indeed! and matter for fruitful reflection. Campanella was capable of a heroism impossible either to Galileo or Descartes. And the chief reason was that the Dominican monk was impelled, not merely by an intellectual love of truth, but by a soldier-like devotion to the Captain of his salvation. It is a warning also against any sectarian interpretation of the martyr spirit to remember that Campanella was not a Protestant, nor had he any Protestant leanings. He was entirely faithful to the Roman Catholic Church, though, as in the case of many other noble martyrs within that Church, it probably took in his imagination an ideal form far other than the reality.

At any rate, the treatment he had received enabled him with conspicuous sincerity to declare that in defending religion he had no personal interest to serve. Thus, in the preface to the work previously quoted, he says, "Not with hope of gain have I written, as do most, but persecuted by incessant suffering. Nor am I driven by fear, I, whose

courage did not fail after threefold and fourfold torments. But moved only by the love of truth I offer to all men the certainty not of ignorance nor conventional pretence, but of religious power and fact. For this power and fact I rest partly on the perceptions of my own experience, partly on careful research into the experience of others, partly on that finer sense by which humanity is beginning to scent out the things that transfigure it to a height of glory not to be reached by logic."

These words are suggestive of the mysticism we have already attributed to the writer. But they also show a strong feeling that the real evidences of religion lie not in books but in the experience of the soul. And they also show that Campanella had no need of the humiliating pity we naturally feel for weaker souls like Galileo. He was conscious not merely of bright glimpses of truth, but of a divine life, in which he breathed the peace that passeth all understanding; and in this he lived secure above the reach of persecution.

We cannot follow out the quiet and uneventful life that followed. A faithful disciple, Tobias Adamus of Saxony, carried off Campanella's manuscripts from his prison, and had them printed in Germany. They were read extensively, and many liberal-minded ecclesiastics felt a warm in-

terest in the immured philosopher. But Spanish tyranny kept its grasp upon him until the first quarter of the new century had passed. And then at length Urban VIII., knowing him through his works, obtained his release, not without urgent intercession, from Philip IV. Emerging from his living tomb, the grey-headed martyr of science was removed to Rome, still nominally a prisoner of the Inquisition. In 1629, at fifty-one years of age, he was finally discharged ; but as the hostility of Spain might still be feared, it was thought safer to put him under the rising power of Spain's great rival, France. The dark intriguing character of international relations at that time may be suggested by the circumstances of his journey. He had to leave Rome under the double protection of a disguise and of the French Ambassador's coach. Thus he reached Paris about 1634, and was received with ostentatious favour by Cardinal Richelieu. A pension was assigned to him, and the French statesman often consulted him for information on the affairs of Italy. For the most part, however, he lived with the brethren of his order in the Dominican convent, where he died in March, 1639, at the full age of seventy years.

THE END.













